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Series/1

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IBM Series/1
Data Collection Interactive
RPQs D02312, D02313, and D02314
Custom Feature

First Edition (August 1979)

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Preface

This publication is the primary source of information for IBM Series/1 Data Collection Interactive users and is organized as follows:

- Chapter 1 explains the principles of the system.
- Chapter 2 describes the I/O commands and I/O operations.
- Chapter 3 contains physical planning specifications and procedures for installing the system accessories.
- Chapter 4 describes the operator tasks when using entry stations and presents operator procedures for problem determination.
- Appendix A contains information for personalization.
- Appendix B shows segment identifications that you code to obtain characters for display.
- Appendix C describes the supplies used with your system.
- Appendix D contains the forms used with your system.
- Appendix E contains a control diskette data loading procedure to be used at IPL time if you do not have Program RPQ P82600 installed.

This publication is intended for customer executives, experienced programmers who require machine code information, customer technicians, and customer operators.

Other users of this publication are IBM customer and system engineers, and the IBM installation planning representative.

The reader should be familiar with Series/1 terminology, and should understand data processing terminology and concepts.

The reader should also have a general knowledge of data collection systems.

Contents

Chapter 1. Description of the Series/1 Data Collection Interactive Attachment Feature 1-1
Current Methods of Data Collection 1-1
Current Uses of Data Collection 1-1
- Time Recording 1-1
- Pay-For-Production Accounting 1-1
- Comparison-To-Standards Accounting 1-1
- Work-In-Process Status Accounting 1-1
- Inventory Control Accounting 1-2
- Action Accounting 1-2
- Cost Accounting 1-2

Series/1 Data Collection Interactive Attachment Feature 1-2
- Entry Stations 1-4
- Series/1 Data Collection Interactive Output Data Formats 1-4
- Loop Multiplexer and Master Scheduler Cards 1-5

Series/1 Data Collection Interactive Basic Features 1-6
- 5235 Data Entry Station 1-7
- 5236 Data Entry Station 1-9
- 5234 Time Entry Station 1-10
- 5239 Value Read Module 1-11

Series/1 Data Collection Interactive Loops 1-13
Series/1 Data Collection Interactive Terminology 1-14
- Actions 1-15
- Buffers 1-15
- Data Checking 1-18
- Value Read Parity Checking 1-18

Badge Types 1-19
Card Types 1-19

Chapter 2. Input/Output Operations–Commands, Status, and Resets 2-1
Series/1 I/O Addressing 2-1
Operate I/O (IO) Instruction 2-1
- Immediate Device Control Block (IDCB) 2-1
- Device Control Block (DCB) 2-1

Series/1 I/O Commands 2-3
- Read ID 2-3
- Prepare 2-4
- Device Reset 2-4
- Start 2-4
- Start Diagnostic 2-6
- Start Cycle Steal Status 2-7
- Halt I/O 2-7

Direct Program Control (DPC) Operation 2-8
Cycle-Steal Operation 2-9
Series/1 Status Information 2-10
- Condition Codes 2-10
- Interrupt ID Word 2-10
- Cycle-Steal Status Words 2-11

Programming Considerations 2-12

Chapter 3. Physical Planning and Installation 3-1
System Planning 3-1
Installation Schedule of Events 3-1
Central Facilities Maintenance 3-4
5235 Data Entry Station Features and Specifications 3-6
5236 Data Entry Station Features and Specifications 3-8
5234 Time Entry Station Features and Specifications 3-9
5239 Value Read Module Features and Specifications 3-10
Planning Checklists 3-11
- Floor Plan 3-11
- Loop Assignments 3-11
- Loop Cable Characteristics 3-11
- Electrical and Electromagnetic Noise 3-12
- Preventing Electrical and Electromagnetic Noise 3-12
- Grounding the Loop Cable 3-12
- Loop Cable Length Requirements 3-13
- Loop Cable Routing 3-13
- Series/1 Data Collection Interactive Accessories 3-14
- Customer-Supplied Items 3-16

System Installation 3-18
- AC Power 3-18
- Loop Cable 3-18
- Mounting Brackets 3-21
- Station Connector Housing and Cover 3-21
- Contacts Closure Housing and Cover (Optional Feature) 3-22
- Station Connectors 3-23
- Station Connector Addresses 3-25
- Contacts Closure Connector 3-26
- Loop Connector 3-27
- Ring Out and Test Total Loop 3-28

Value Read Planning 3-29
- Value Read Planning Checklist 3-29
- Floor Plan of Value Read Installation 3-29
- AC Power for the 5239 Value Read Module 3-30
- Mode Selection 3-30
- Device-Dependent Options 3-30
- Signal Cable Wiring 3-30
- Hardware Requirements 3-33
- External-Device Supplier Information 3-33

Installation Instructions for Value Read 3-33
- IBM-Supplied Items 3-33
- Customer-Supplied Items 3-33
- Cabling the Module 3-34
- Signal Cable Termination 3-34
- Mode and Option Selection 3-34
- Value Read Module Mounting Bracket Template 3-34

External-Device Supplier Value Read Information 3-36

Chapter 4. Operator Tasks and Procedures 4-1
Operating the Data Entry Station 4-1
- Power On/Off Switch 4-2
- Status Indicators 4-2
- Action Keys 4-2
- Numeric Keys 4-2
- Card Reader 4-3
- Badge Reader 4-4
- Mode Switch 4-5

Operating the Time Entry Station 4-5
Operating the Value Read Module 4-6
Backup Procedures 4-6
Power Interruption 4-6

Operator Tasks 4-7
Problem Determination Guide 4-7
Action Key Test 4-12
Value Read Tests 4-13
Wrap Test Selection 4-14
Training Entry Station Operators 4-27
What is an Entry Station? 4-27
What Actions are to be Recorded? 4-27
What Entries are Necessary to Record Each Action? 4-27
How is Data Entered? 4-28
How is a Problem Recognized When Recording an Action? 4-28
How the Entry Station Should Appear Before an Action is Entered 4-28
How the Data Entry Station Should Appear After Pressing an Action Key 4-28
How the Entry Station Indicates that it Accepted an Entry 4-28
How the Entry Station Indicates that the Action is Completed 4-29
What Steps Should be Taken When a Problem is Recognized 4-29

Appendix A. Personalization A-1
Transaction Definition Records A-1
System Configuration Format A-1
Transaction Definition Format A-1
Transaction Checking Definition Format A-2

Appendix B. Data Message Format B-1

Appendix C. Supplies C-1
Cards C-2
Badges C-3
Badge Layout Specifications C-4

Appendix D. Forms D-1
Action Cards D-3

Appendix E. Control Diskette E-1

Index X-1

Chapter 1. Description of the Series/1 Data Collection Interactive Attachment Feature

This chapter describes current uses of data collection, and shows how the IBM Series/1 Data Collection Interactive attachment feature expands upon existing methods.

Current Methods of Data Collection

Data is collected by many methods, and for many purposes. The most common methods of data collection are:

- Observation and memory
  This is an inexpensive method of data collection, but it is also generally ineffective.
- Pencil and paper
  This is a common method of data collection, but prone to errors. As a business increases in size, this data becomes cumbersome to handle. If processed by machine, it must be recorded in a machine-readable form to be usable.
- Time clocks
  This is a common method of data collection for employee attendance accounting. Frequently, though, this data must be recorded in another form to be usable; such as, key entries on cards.
- Entry stations
  This is a method of data collection that records actions at their source, the point where the actions take place, yet collects data in machine-usable form at a central location.

In your business, you are collecting data now, and probably by several of the methods described.

Current Uses of Data Collection

Uses of data collection vary from time recording to a comprehensive system for cost and work status accounting. Some of the most common uses of data collection are described here.

Time Recording

Time recording is often a requirement at hospitals, hotels, amusement parks, retail stores, warehouses, airports, printers, and process or manufacturing plants. Any business that hires employees and pays them by the hour needs to collect attendance data.

Pay-For-Production Accounting

Any business paying employees or contractors for the number of items they make, assemble, load, distribute, or install needs to collect "pay-for-production" data. This use of data collection is normally associated with a manufacturing environment, but can also be related to a business charging for services by the hour.

Comparison-To-Standards Accounting

Any business comparing employee or machine efficiency to standards needs to collect production data. This can be a separate data collection system, or can be a part of a system that collects other data; such as, time of attendance. Often, a simple time collection system can be expanded to a "comparison-to-standards" system with very little additional effort or cost. This use of data collection is normally associated with a plant environment, but can also be related to a service business.

Work-In-Process Status Accounting

A business that has many items being scheduled through a plant at one time frequently needs to know the status of a particular item and when it will be completed. Schedules change, and as they do, work priorities change. Items in-process must be located and rescheduled. Frequently, a particular job must be expedited and traced through to completion. This use of data collection is normally associated with a plant environment, but it can also apply to a complex project requiring many steps being completed according to a master schedule.

Inventory Control Accounting

A business that inventories many items of various quantities needs to collect inventory data. This is often a requirement for a retail store, a wholesale distributor, a manufacturer who maintains an inventory of parts, or the circulation department of a library.

Action Accounting

A business that needs to record when employees perform their duties requires action completion data. An example of this is recording the dispensing of medication at a hospital, or clocking the checkpoint stations of a security guard.

Cost Accounting

Any business that manufactures more than one part or product needs to know what costs are associated with which part or product. This is necessary to determine which products are contributing to the profit of the company, and which products are being made at an unsatisfactory profit. This information is vital to determine whether to make or purchase a part, increase effort on one product, or reduce or eliminate effort on another. This use of data collection is normally associated with manufacturing operations.

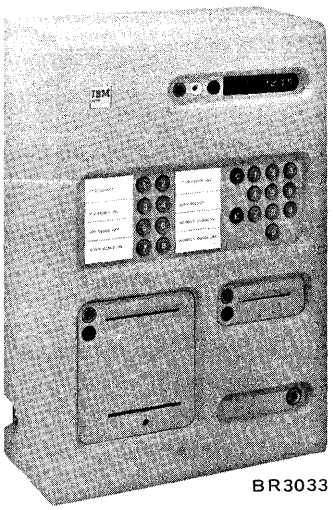
Series/1 Data Collection Interactive Attachment Feature

The Series/1 Data Collection Interactive attachment feature is a simple and convenient way for the production employee to enter data:

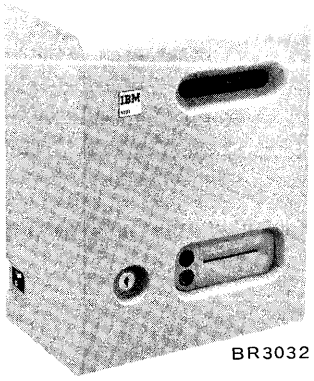
- At the place of the action
- At the time of the action
- In a form that becomes machine readable

The Series/1 Data Collection Interactive attachment feature is flexible. This system can first be installed to perform some simple data collection task, such as time recording. Then, it can be expanded to a system for collecting data so that a computer can calculate cost per product and compare machine efficiency to standards. Your Series/1 Data Collection Interactive attachment feature does not give you a data collection solution that is unalterable, but rather gives you a versatile solution that you can change to encompass new uses in a changing environment. A Series/1 Data Collection Interactive attachment feature, as shown in Figure 1-1, can have:

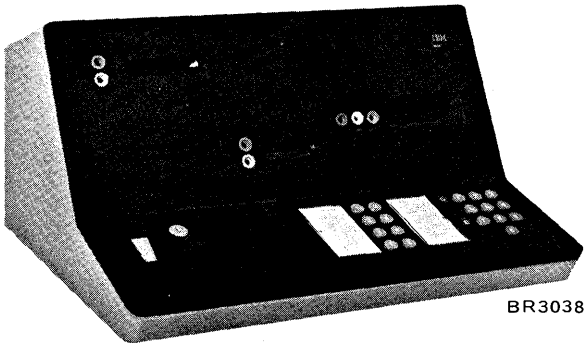
- Up to 31 entry stations
  - 5235 Data Entry Stations for card, key, badge, and value read entry
  - 5236 Data Entry Stations for card, key, badge, and value read entry
  - 5234 Time Entry Stations for badge entry only
  - 5239 Value Read Modules for BCD/TTL parallel or 1-of-10 dry contact input
- One Series/1 with appropriate RPQs (D02312, D02313, and D02314)
  - The Series/1 processor collects data from entry stations; then, with proper programming, it produces reports for customer use, or stores data for future use.
- Attachment feature card RPQs
  - A loop multiplexer card
  - A master scheduler card



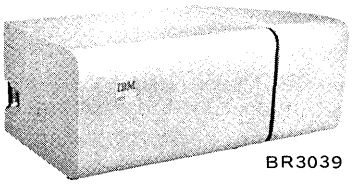
5235 Data Entry Station



5234 Time Entry Station



5236 Data Entry Station



5239 Value Read Module

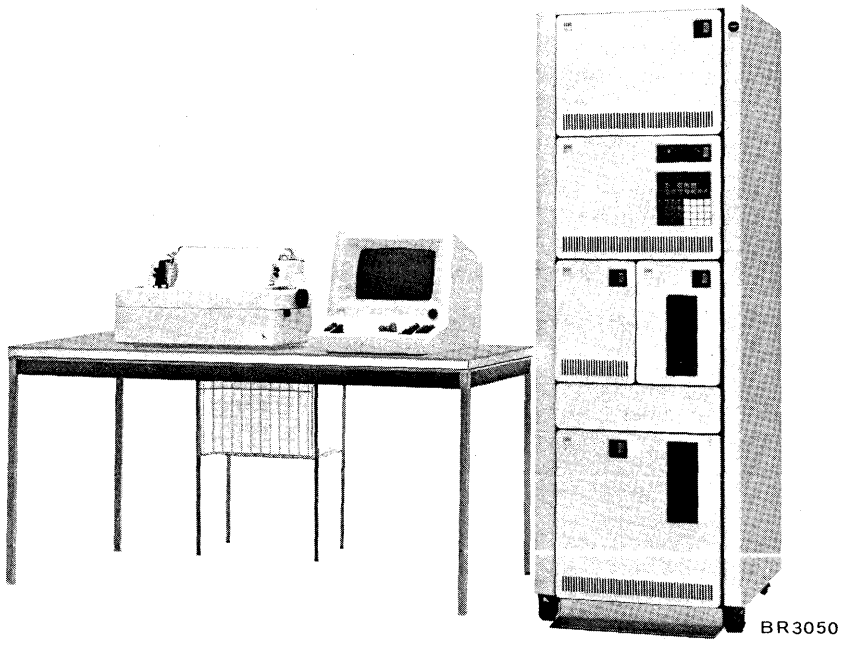


Figure 1-1. Entry stations and Series/1

Entry Stations

Entry stations for the Series/1 Data Collection Interactive Attachment feature are located at the work areas. These entry stations are compact and can be located next to a production machine, in a shipping or receiving department, or at each nurses' station of a hospital. This allows employees to record each action at the time and place it occurs.

The entry station receives data entered by:

- Badges
- Punched cards
- Numeric key entries
- Value read entries

An entry station lets you specify the proper action, such as the completion of a job or the rejection of a quantity of parts.

Action Selection

An action can be composed of any combination of badge, card, key, and value read entries up to the maximum number allowed, and you may specify up to eight separate actions that can be entered at *each* data entry station. This allows you to personalize your Series/1 Data Collection Interactive attachment feature to suit your data collection needs.

Badge Entry

Badge entry is a fast method of entering small amounts of data. It is especially useful for types of data that does not change often and must be entered with great frequency, such as employee identification. An entry station can have either a magnetic badge reader or a punched hole badge reader. Any number of badges can be entered for an action.

Card Entry

Card entry is an accurate method of entering predetermined data relative to a particular action, such as order number or part number. Up to two cards can be entered for an action.

Key Entry

Key entry is the method for entering variable data relative to a particular action, such as a quantity. An entry station allows up to three numeric entries of up to eight digits each for an action.

Value Read Input

Value read is a method for entering a value from an external device. Using the 5239 Value Read Module, values of weights, counts, temperature, time, and similar values can be input into either the 5235 or 5236 Data Entry Station. Up to eight digits can be input for each value read operation.

Contacts Closure (Relay Output)

A set of relay contacts can be momentarily switched, based upon successful output of a data record or successful reading of a badge into a badge buffer. Contacts can also be programmed to switch.

Audible Indicator

The audible indicator, when installed in the entry unit, produces an audible tone at the completion of each badge read or at the completion of each transaction.

Series/1 Data Collection Interactive Output Data Formats

Data entered at an entry station is available to the Series/1 processor as 178-byte or 179-byte records:

Data from the badge buffer is 178 bytes; data from the data buffer is 179 bytes.

Actions at entry stations create separate records at the Series/1. Each action has a time associated with it, and this time can be placed in the record if you choose.

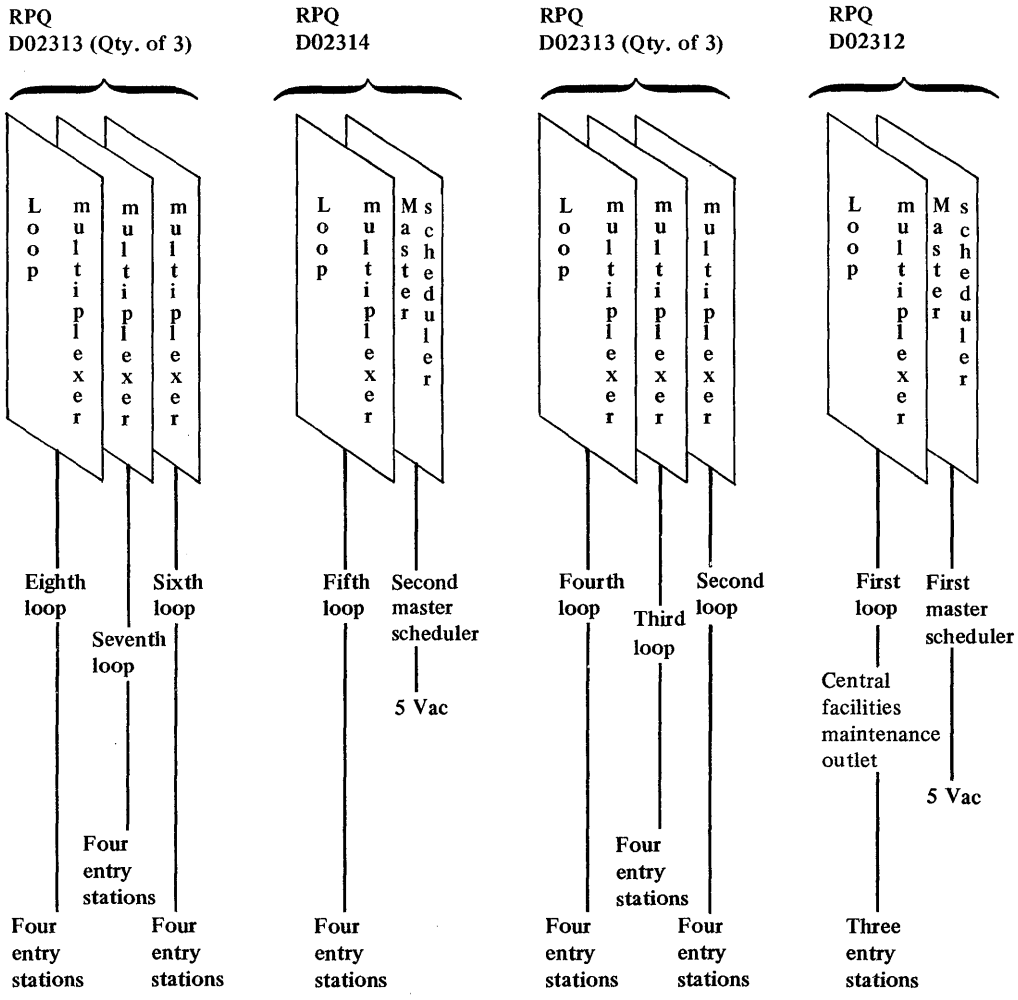
The following section describes the principles of the Series/1 Data Collection Interactive system. When you finish reading this section, you should know how the Series/1 Data Collection Interactive attachment feature works to simplify your data collection.

Loop Multiplexer and Master Scheduler Cards

The Data Collection Interactive attachment feature resides in the Series/1 Processor or IBM 4959 Input/Output Expansion Unit, and consists of two attachment feature cards (see Figures 1-2 and 1-3). One card contains the master scheduler and the other contains the loop multiplexer.

The master scheduler controls the interface between the Series/1 and the loop multiplexer. Up to four loop multiplexers can be controlled by one master scheduler, with a maximum of two master schedulers per system. The loop multiplexer cards do not respond to Series/1 I/O channel commands except to propagate the I/O channel 'poll' signal.

The loop multiplexer drives the loop for up to four data entry stations.



Minimum configuration =
1-RPQ D02312 (three entry stations)

Maximum configuration =
1-RPQ D02312
6-RPQ D02313
1-RPQ D02314
} 31 entry stations

Figure 1-2. Series/1 Data Collection Interactive RPQs

Series/1 Data Collection Interactive Basic Features

The Series/1 Data Collection Interactive is made up of entry stations and a Series/1 with appropriate Data Collection Interactive RPQs (D02312, D02313, and D02314).

The entry stations are located as near as possible to the data being collected. This can be at a receiving department, beside a machine in a manufacturing department, at the employee entrance to a hotel, or at a nurses' station of a hospital.

There are three types of entry stations: the 5235 Data Entry Station, shown in Figure 1-4; the 5236 Data Entry Station, shown in Figure 1-5; and the 5234 Time Entry Station, shown in Figure 1-6. The 5239 Value Read Module is shown in Figure 1-7.

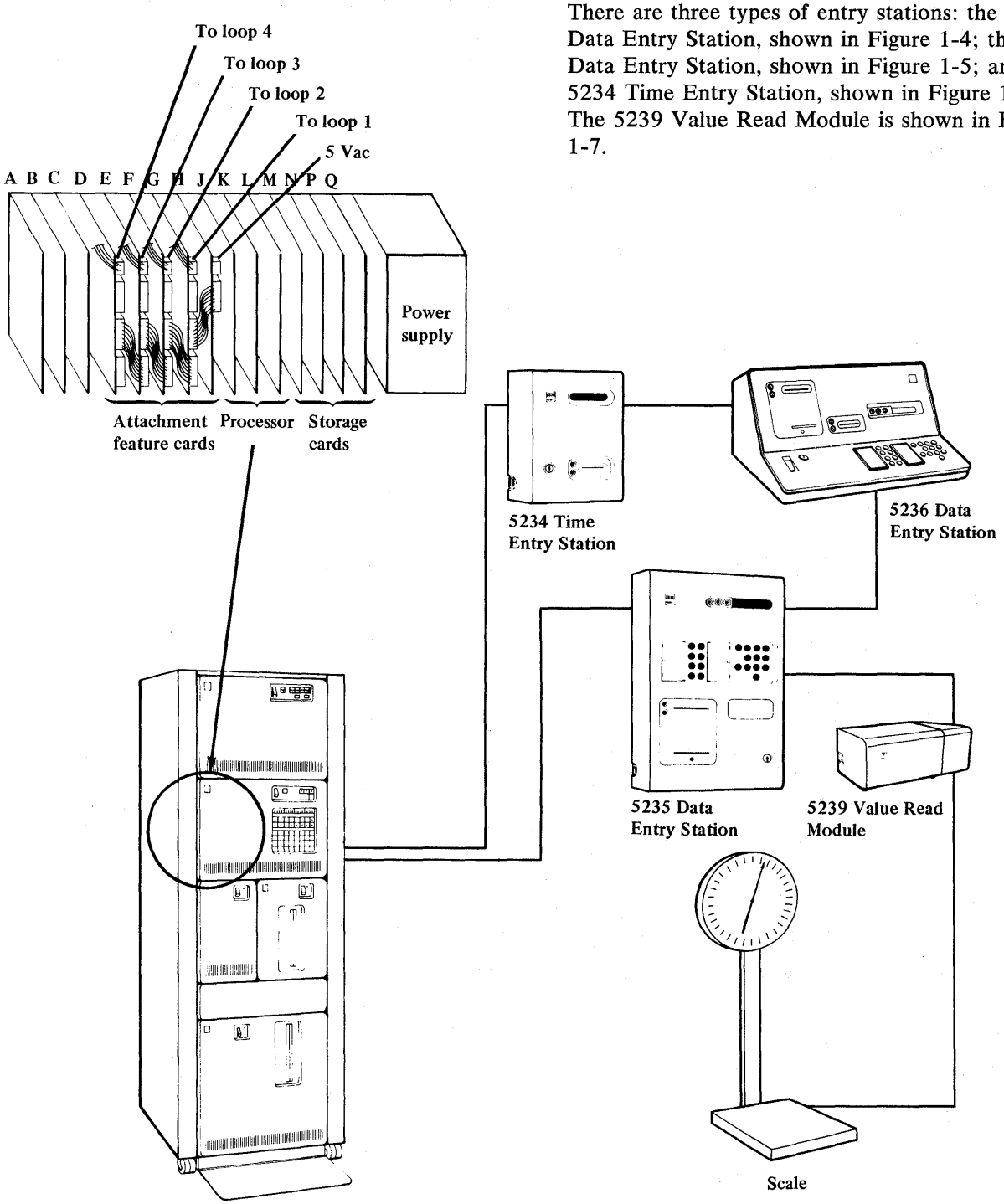


Figure 1-3. A Series/1 Data Collection Interactive system

5235 Data Entry Station

This data entry station has the following standard features:

- Eight action keys
- Numeric keyboard containing 10 numeric data entry keys and two control keys
- Mode switch
- Eight-position display

The optional features include:

- Badge reader
- Card reader
- Audible indicator
- Contacts closure
- Value read attachment feature

Each action key can designate a different type of action. Before using the Series/1 Data Collection Interactive, personalize your system to meet your needs. To do this, designate the action for each particular action key, specify if the mode switch must be turned on with a supervisor key for the action to be valid, and specify the required entries for that action. Each action at a data entry station can have any combination of card entries (maximum of two), any combination of key entries and value read entries (maximum of three), and badge entries (no maximum number).

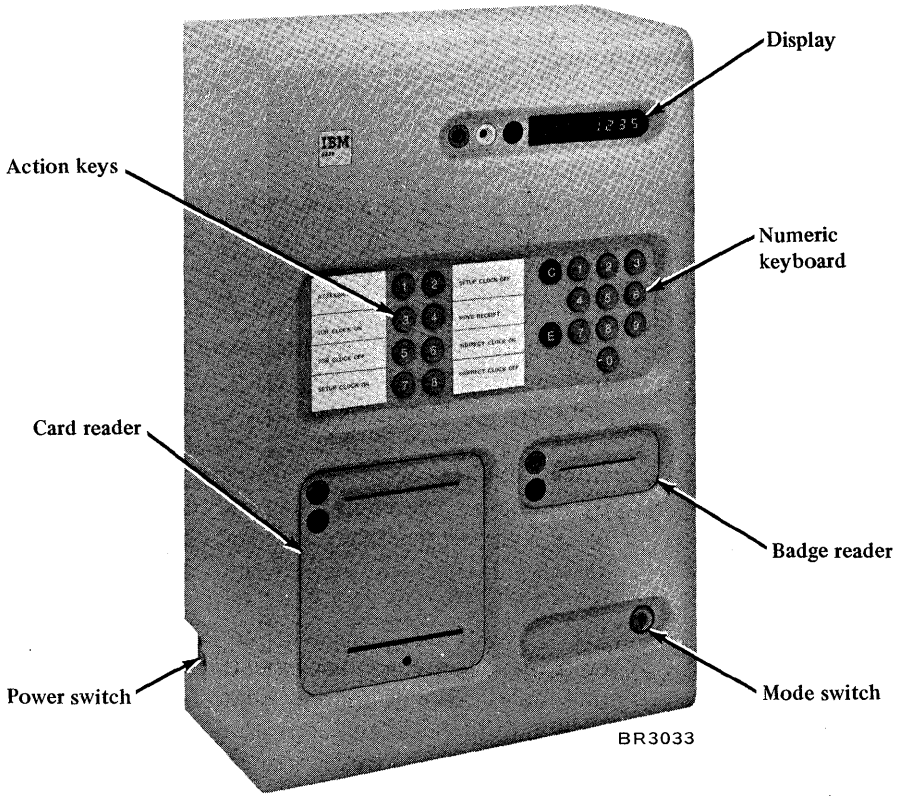


Figure 1-4. 5235 Data Entry Station

For example:

- Action key 1 can be assigned for attendance recording. In this case, badge input may be all that is required.
- Action key 2 can be used to record a quantity of a particular item inspected by an employee. In this case, a prepunched card containing item number, a quantity of good items entered by key input, a quantity of rejected items entered by key input, and a badge containing the employee number may all be required to complete the action.

Note: Action key 8 and action key 7, depending on the selected mode of operation, are dedicated to the value read feature when that feature is installed.

The time of day is continuously displayed on the 8-position display except when numeric data is entered by keys or value read input. The numeric data or value read data is displayed as it is entered.

In addition, internal time-of-day and day-of-week read out is provided from the system clock. The time of day is expressed in either continental time (0000-2359) or standard time (0100-1259). The time of day is displayed at the data entry station and time entry station when no other display is required. The day of week is maintained as a single digit (1–7).

Interaction is provided by allowing a message of up to eight numeric (0–9) and/or some limited alpha characters to be displayed on a specific data entry station or sent to all data entry stations. This message is displayed until another message is sent or until an erase operation is performed. See Appendix B for additional information about how to display messages.

In addition to the standard numeric keyboard, the entry station may have the following options:

- Either magnetic badge or hole badge reader
- Either 96-column card reader or 80-column card reader
- Audible indicator
- Contacts closure
- Value read attachment feature

When the value read attachment feature is installed, either a card reader or a badge reader can be installed, but not both.

The value read attachment feature provides a method for entering output from a customer device directly into the data entry station. Values of weights, counts, temperature, time, and other similar values are entered into the data entry station through the 5239 Value Read Module. The values enter the value read attachment located in the data entry station. Before attaching the external device to the 5239 module, the customer must ensure compatibility between the module and the external device. (Refer to "External-Device Supplier Information" in Chapter 3.)

Value read data is entered automatically into a Series/1 data record instead of manually keying the data. This data can be combined with keyed and badge or card input to complete an output record. Up to eight numeric digits can be read using four modes of operation, which are selected at the 5239 Value Read Module:

- Manual
- Protected
- Semiautomatic
- Automatic

The audible indicator, when installed in the entry unit, produces an audible tone at the completion of each badge read or at the completion of each transaction.

The contacts closure feature provides a double-pole, double-throw relay (two contacts normally open and two contacts normally closed). Following a successful badge read or a completed transaction, the relay activates for a minimum of 0.50 second. The contacts of the relay can be used to activate or deactivate external devices. These external devices and the power to drive them must be provided by the customer. If the activation period of the external device must be longer than 0.50 second, the customer must provide either a time-delay relay or a circuit that "latches" for the required time after the activation of the contacts closure relay. Deactivation of the delay circuitry must be provided at the completion of the operation.

The contacts closure feature and/or the audible indicator feature, when installed in the entry unit, provide the following indications:

Type of transaction	Indication
Time and attendance	After every badge
Multiple badges	After every badge
No badge media	After all media properly entered
Multi-media (including badge)—badge entered last	After badge read
Multi-media (including badge)—badge not last	After all media properly entered

In addition to the preceding, these features can be programmed to activate or deactivate.

5236 Data Entry Station

The 5236 Data Entry Station is identical in operation and features to the 5235 Data Entry Station. The shape of the 5236 allows desk-top operation with increased operator convenience. The 5236 is intended for non-industrial application areas, such as secretarial areas, hospitals, libraries, and similar environments.

For a description of the 5236 features, refer to "5235 Data Entry Station."

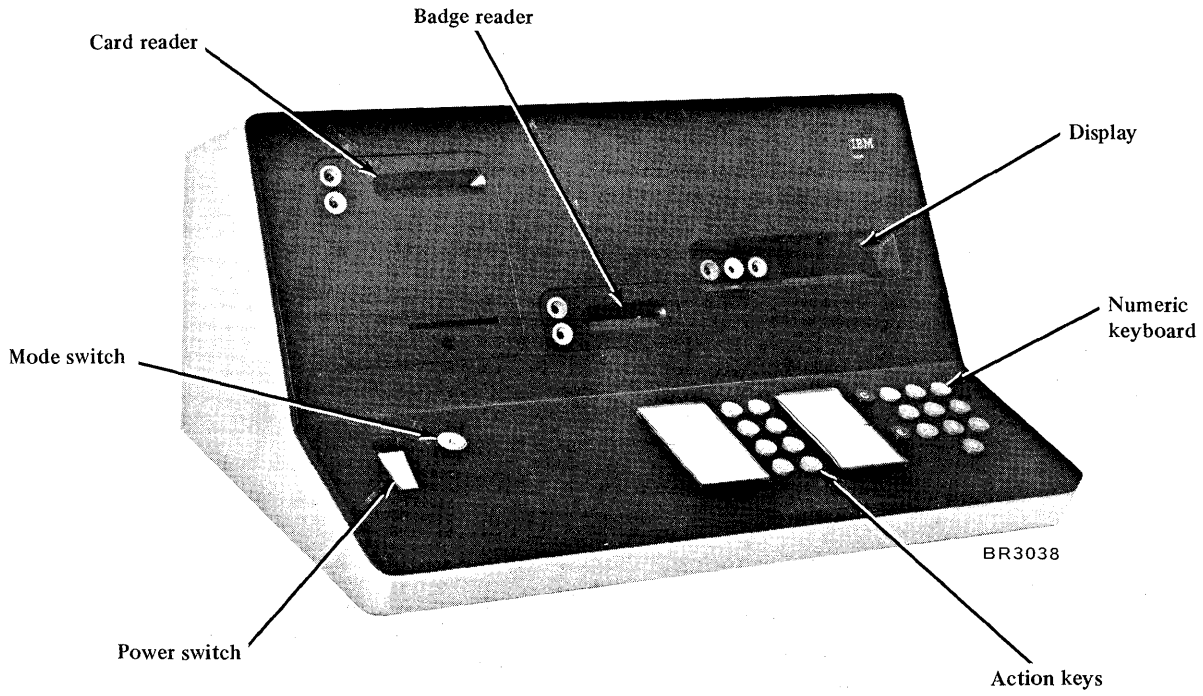


Figure 1-5. 5236 Data Entry Station

5234 Time Entry Station

The 5234 Time Entry Station is similar to the data entry station, except that a badge reader is its only method for entering data. For each badge entered, the time of the entry is recorded. The following options are available on the time entry station:

- Audible indicator
- Contacts closure

For descriptions of these options, refer to "5235 Data Entry Station."

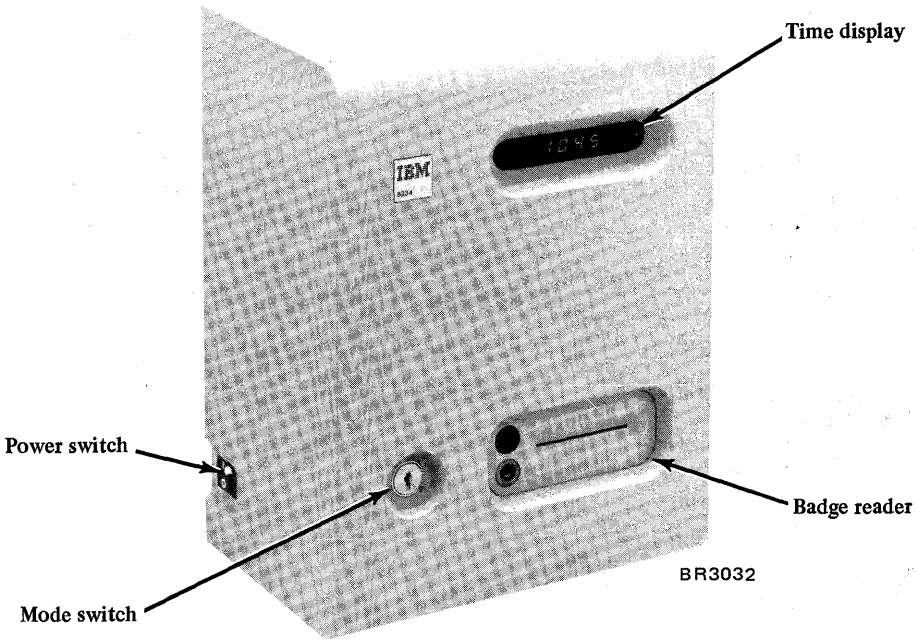


Figure 1-6. 5234 Time Entry Station

5239 Value Read Module

The 5239 Value Read Module allows external values, such as weight, count, temperature, and similar values, to be input into the Series/1 Data Collection Interactive attachment feature. The 5239 Value Read Module, shown in Figure 1-7, provides:

- Direct attachment to external devices
- Eight-digit value read
- Four selectable modes of operation
- Wall or pedestal mounting

Features:

- BCD/TTL parallel input (electronic devices)
- 1-of-10 or BCD dry contact input (electromechanical devices)

The value read module can attach to an external device that has compatible signal levels. It is the customer's responsibility to ensure compatibility between the external device and the 5239 Value Read Module. (Refer to "External-Device Supplier Information" in Chapter 3.)

The value read module can accept a maximum of eight digits from one or more external devices. If fewer digits are entered, the value is always right-justified.

Four modes of operation offer a full range of value read capability—from manual operation (or manual protected) to fully automatic operation. These modes are customer selectable. Selection is accomplished by tying lines together at the end of the 1.8-m (6-ft) control cable, which is supplied by IBM. (Refer to Figure 3-31 for mode selection wiring.)

The compact size of the value read module allows for either wall mounting or pedestal mounting. Brackets are provided with the value read module for wall mounting the module. Rubber feet are standard on the bottom of the module for pedestal mounting.

The 5239 module can be used with either newer electronic devices that have a BCD/TTL parallel output or older electromechanical devices that have the 1-of-10 dry contact output. The electromechanical operation is compatible with devices attached to previous IBM data collection systems (357, 1030, and 2790). (See Figure 3-42 in Chapter 3 for cable conversions.)

The four customer-selectable modes are:

- Manual
- Protected
- Semiautomatic
- Automatic

Generally, one particular mode is selected for use at each 5235 or 5236 Data Entry Station.

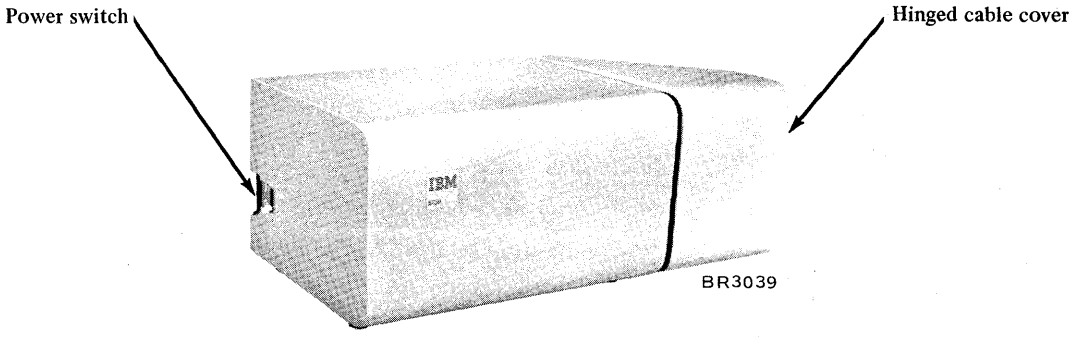


Figure 1-7. 5239 Value Read Module

Manual Mode

- Requires manual initiation to read the external value into the entry station.
- Operator can key enter the value or read the value from the external device by pressing action key 8 after the field indicator appears in the display.
- Actions 1–7 must have at least one field personalized for key entry.
- Actions 1–7 may have any key entry field satisfied by key entry or with value read data.
- Data is always displayed right justified.
- Action key 8 is dedicated to initiating a value read into key entry field 1, 2, or 3 of any other action; it cannot perform any other function.
- The enter (E) key must be pressed to store the data in the data output buffer.

Protected Mode

- Only the value read from the external device can be entered into key entry field 1 (F1) of action 7; the keyboard is locked out and cannot be used. Do not attempt to read the external value until the 7, F1 appears in the display.
- Action 7 (F1) is dedicated to value read and must be personalized for key entry.
- Action key 8 is dedicated to initiating a value read into key entry field 1 of any other action; it cannot perform any other function.
- Actions 1–6 function normally; they may be used for the manual mode of operation or for functions other than value read.
- Additional key entries may be made for F2 or F3 of action 7.
- Data cannot be entered into key entry field 1 (F1); it is reserved for value read data only.
- The enter key must be pressed to store the data into the Series/1 data buffer.

Semiautomatic Mode

- A signal from an external source of your choice initiates action 7 or 8 and causes the external value to be read and displayed automatically at the entry station.
- Actions 1–6 function normally; they may be used for the manual mode of operation or for functions other than value read.
- Action 7 or 8 must be used for value read. Customer selection of control lines dictates whether action 7 or 8 or both are used for this mode.
- Action 7 or 8 must be personalized for at least one key entry.
- Manually entered data cannot be entered into key entry field 1 (F1); it is reserved for value read data only.
- The enter key must be pressed to store the data into the Series/1 data buffer.

Automatic Mode

- Requires no operator action to read or store an external value.
- When a signal from an external source is activated, the value at the external device is read into the display at the entry station and is then entered automatically into the Series/1 data buffer.
- Actions 1–6 function normally; they may be used for the manual mode of operation or for functions other than value read.
- Action 7 or 8 must be personalized for at least one key entry. F2 and F3, if personalized, must be entered by an operator before the next external source activation.

Series/1 Data Collection Interactive Loops

The Series/1 Data Collection Interactive system can have up to 31 entry stations. These entry stations are attached to two-wire cables called loops. Each loop is attached to a multiplexer card in the Series/1. The first loop can have up to three entry stations plus the Central Facilities Maintenance (CFM) outlet; additional loops can have up to four entry stations. Each loop can be up to 1525 meters (5000 ft) long, and entry stations on a loop can be a maximum distance of 610 meters (2000 ft) apart.

The Series/1 Data Collection Interactive shown in Figure 1-8 has two loops. The first loop (loop 1) has three entry stations; the other loop has four entry stations. The Series/1 collects data entered through entry stations. This data is then processed by the Series/1.

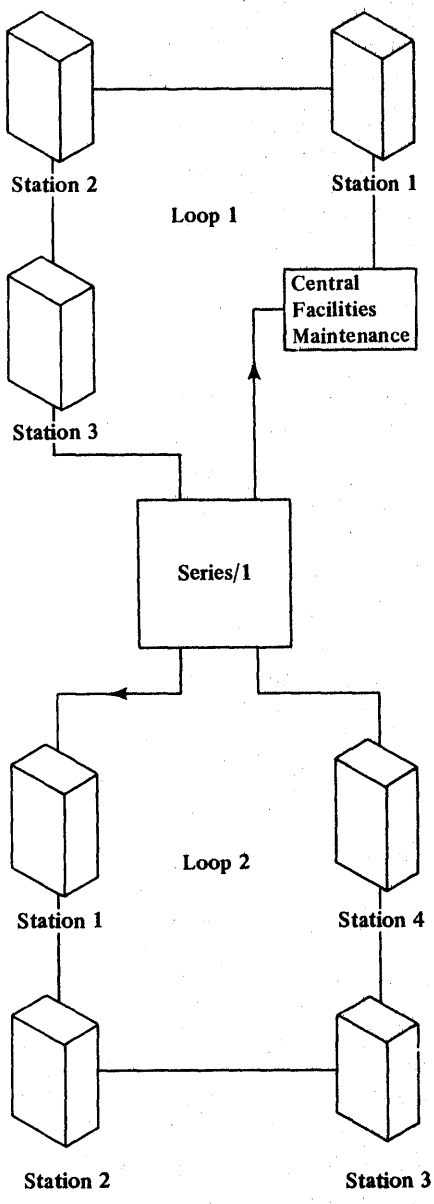


Figure 1-8. Series/1 Data Collection Interactive with two loops

Series/1 Data Collection Interactive Terminology

The Series/1 Data Collection Interactive system has four types of entry:

- Badge entry
- Card entry
- Key entry
- Value read entry

Entering data at an entry station is called an action, which can be composed of any one or a combination of the four types of data entry. The entries for an action are accumulated within the loop multiplexer in an area of storage called a *buffer*.

An action is completed when all required entries are made at the entry station. When the action is completed, the loop multiplexer passes the data stored in the buffer to the scheduler, as shown in Figure 1-9. The scheduler passes buffers to the Series/1 in one of two formats:

- When the action has card, key, or value read entry, the scheduler passes a *data buffer*.
- When the action has only multiple badge entries, scheduler passes a *badge buffer*.

If the action has card, key, value read entry, and more than one badge entry, the loop multiplexer passes a data buffer followed by one or more badge buffers.

The data buffer can contain the information entered by a single badge. A badge buffer, however, contains information from up to eight badges. The badge buffer reduces the number of records created when many badges are being entered, and it increases the number of badges that can be entered in a given period of time. This can be of considerable importance at times of peak activity, such as attendance recording at the beginning or the end of a shift.

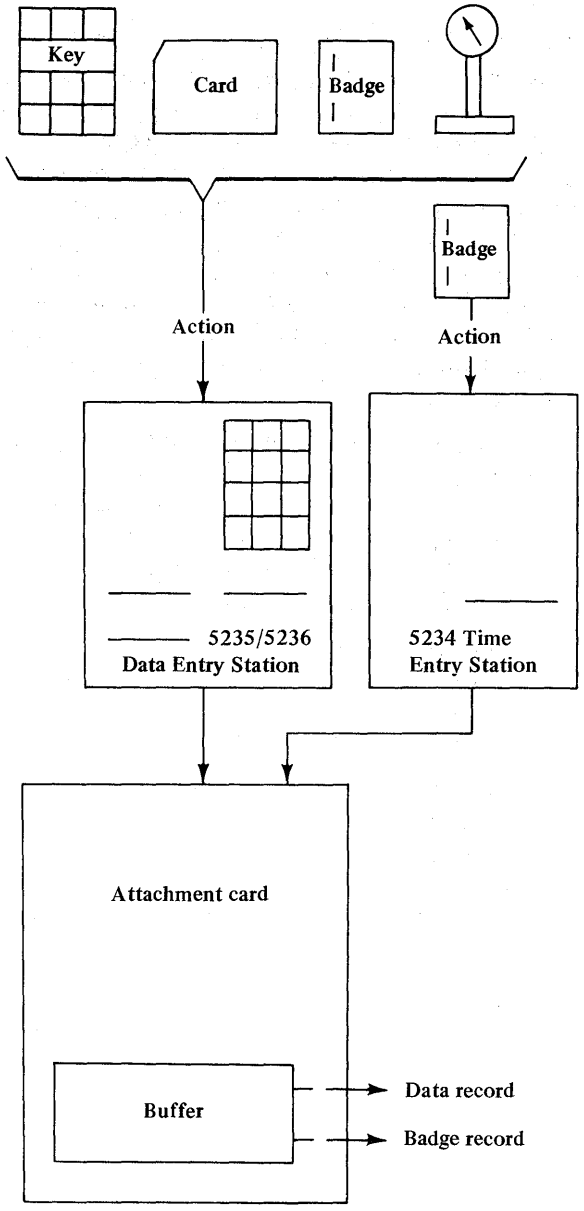


Figure 1-9. Records created for actions

Actions

Entering data at an entry station is called an action. For the 5234 Time Entry Station, only one action is possible, and the only means of entering data is by badge. For the 5235 or 5236 Data Entry Station, eight types of actions are possible. When you personalize the system, you describe the means of entering data for each action at each entry station. Data is entered by key, badge, card, or by value read. For example, one action can require data entered by key entry and card, while another action can require a value read entry and a key entry.

If the value read attachment feature is installed in the data entry station, eight actions are still possible; however, the actions from action key 8 and action key 7, depending on mode selection, are dedicated to the value read feature for use in initiating the reading of external values.

The entries for an action are accumulated in a buffer within the loop multiplexer. When the action is completed, the Series/1 program creates a record from the data stored in the buffer.

In addition, the data entry station has a mode switch. One key to this switch is a supervisor key. When personalizing the system, you can designate any action to require the supervisor key to be turned on before that action is recognized by the system.

Buffers

As data is entered, the loop multiplexer collects the data in a buffer and the Series/1 program produces records from this buffer. The buffer can be used for either of two purposes: a data buffer to assemble data records or a badge buffer to assemble multiple badge records. If any of the data for an action is entered by card, key, or value read input, the buffer is used as a data buffer. If all of the data for an action is entered by badge, the buffer is used as a badge buffer. If the data for an action is entered by key, value read, card, and by more than one badge, the buffer is used first as a data buffer and then as a badge buffer.

A buffer has one format when used as a data buffer, and another format when used as a badge buffer. This format determines where data is stored in the buffer. The Series/1 program must know where the data is stored.

Data Buffer

When used for data, the buffer contains 179 positions, and stores data entered for the action until the action is complete. The Series/1 then creates the data record from the data in the buffer. An action can have as many as three numeric entries through key or value read, and either two punched card entries or as many badge entries as necessary. However, only one badge entry is stored in the buffer in data format. Additional badge entries are stored in the buffer in badge format.

Each entry is stored in a specific portion of the buffer, as shown in Figure 1-10. A sequence number, created by the Series/1 program, is stored in specific portions of the buffer. This data, not entered at the entry station, is often required to identify the action during later processing. The header (positions 1–10) is passed from the loop multiplexer.

Header	Badge	Key entry 1 / Value read entry 1	Key entry 2 / Value read entry 2	Key entry 3 / Value read entry 3	Card 1	Card 2
1 → 10	11 → 27	28 → 35	36 → 43	44 → 51	52 → 115	116 → 179

Figure 1-10. Data buffer

Data Buffer Format

The data buffer (Figure 1-10) is 179 positions, and is divided as follows:

Field name and positions	Contents
Header	The header contains the following information:
1	• Record code 1 = data record; no associated badge record. 2 = data record; one or more associated badge records follow. 7 = partial data record
2	• Loop ID The loop where the action occurred.
3	• Entry station ID The entry station where the action occurred.
4	• Mode switch setting The setting of the mode switch on the entry station. 0 = supervisor key not on. 1 = supervisor key on.
5	• Action ID The action key pressed for this record.
6	• Day of week The day of week the action was completed.
7–10	• Time of day The hours and minutes in continental time when the action was completed.
Badge 11–27	Magnetic stripe badge (17 positions) or punched hole badge (the first 10 positions). No separate time is recorded for this badge entry. The time that the action key was pressed is stored in the header.

Field name and positions	Contents
Key 1 or value read 1 28–35	The first key entry or value read entry, a number up to eight digits, right-justified. (This means it has leading blanks.)
Key 2 or value read 2 36–43	The second key entry or value read entry, a number up to eight digits, right-justified.
Key 3 or value read 3 44–51	The third key entry or value read entry, a number up to eight digits, right-justified.
Card 1 52–115	The first card entry—the first 64 characters of an 80-column card or the first 32 characters of a 96-column card.
Card 2 116–179	The second card entry—the first 64 characters of an 80-column card or the first 32 characters of a 96-column card.

Badge Buffer

When used for badge data, the buffer contains 178 positions, and stores all badge data entered for an action until the badge record is created by the Series/1 program. Each badge entry and the time of entry are stored in a specific portion of the buffer. A sequence number, created by the Series/1 program, is stored in specific portions of the buffer as shown in Figure 1-11. The header (positions 1–10) is passed from the loop multiplexer.

Header	Badge 1	Badge 2	Badge 3	Badge 4	Badge 5	Badge 6	Badge 7	Badge 8
1 → 10	11 → 31	32 → 52	53 → 73	74 → 94	95 → 115	116 → 136	137 → 157	158 → 178

Figure 1-11. Badge buffer

Badge Buffer Format

The badge buffer (Figure 1-11) is 178 positions, and is divided as follows:

Field name and positions	Contents
Header	The header contains the following information:
1	• Record code 3 = first badge record; one or more associated badge records follow. 4 = intermediate badge record follows a code 2 data record or a code 3 badge record; one or more associated badge records follow. 5 = independent badge record; not associated with any other data or badge record. 6 = last badge record; last record for an action. This code is inserted in any record created automatically by the Series/1 when partially-filled badge buffers are dumped. 9 = abort action; ignore previous records for this action.
2	• Loop ID The loop where the action occurred.
3	• Entry station ID The entry station where the action occurred.
4	• Mode switch The setting of the mode switch on the entry station. 0 = supervisor key not on. 1 = supervisor key on.
5	• Action ID The action key pressed for this record. (Always 1 for a time entry station.)
6	• Day of week The day of week when the action was initiated.
7–10	• Time of day The hours and minutes in continental time when the action was initiated.
Badge 11–31	Magnetic stripe badge (17 positions) or punched hole badge (10 positions). Time of badge entry is always in positions 28 through 31 of the badge buffer.
Other badges 32–178	The badge buffer contains 21 positions each for eight badges, a total of 168 positions. The time of each badge entry is located in the last four positions of each badge field within the badge buffer. For example, this would be positions 49–52 for badge 2, and 112–115 for badge 5.

Data Checking

The Series/1 Data Collection Interactive attachment feature can check cards or badges, or both, to verify that a certain position contains a specified character. If the specified character is not present, the entry is not accepted. This is called data checking.

When personalizing the system, you can specify data checking:

- At any entry station
- For any action
- For card data, badge data, or both
- For a specific character to be present in a specified position

At times, this data checking may be necessary to determine that the correct badge or card is used. Another reason for data checking exists, and that is that a magnetic badge cannot be read by an entry station if it is inserted upside down or backward, but a card or hole badge can. Users of entry stations frequently have large arrows printed on their cards to show the operator how to insert them into the card reader. Properly planned data checking can prevent a card from being accepted by the entry station if it is inserted improperly.

As shown in Figure 1-12, the first card entered for action 2 at data entry station 2 of loop 3 must contain a 3 in column 1. The second card must contain a C in column 1; if it does not, the card is not accepted and a data check indicator light turns on. If the card is inserted improperly, the card is not accepted.

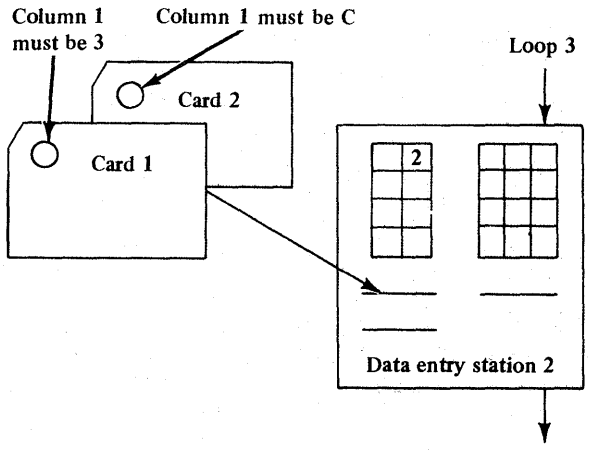


Figure 1-12. Checking data in card entries

Value Read Parity Checking

Parity checking of value read data is optional. When the no parity function is selected, the value read data is not checked for odd bit parity. All data is checked for odd parity if the parity function is selected.

When a parity error of the value read input data is detected, additional data is not accepted by the entry station. The entry station remains operable with the yellow indicator on, and only the value data read before the parity error occurred is displayed in the numeric display. For example, if a parity check occurs at the end of reading the third digit, only two digits are displayed.

The parity check blocks the enter key function. The data is not transmitted to the Series/1, and it remains in the display.

Note: Clearing a parity check requires manual intervention if you are using value read in a fully automatic unattended mode.

Badge Types

Two types of badge readers are available with the entry stations: hole badge and magnetic badge. Consider the following factors when choosing the type of badge you want to use.

Note: See Appendix C, "Supplies," for specifications and instructions for ordering these badges.

Hole badge

- Up to 10 numeric characters can be coded on a badge.
- Punched coding can be read visually.
- Any damage, such as torn badges, that impairs badge reading can usually be visually detected.

Magnetic badge

- Up to 17 numeric characters can be coded on a badge.
- Magnetically coded numbers cannot be read visually; therefore, security is provided.
- Coding can be lost if badge comes near a magnetic field. Badge reading can be impaired without visual detection.

Card Types

Two types of card readers are available with the data entry station: 96-column and 80-column. In both cases, the entire 96-column card or 80-column card must be inserted.

96-column cards

- Columns 1–32 (top tier) can be read.
- A 64-character set, including blanks, is recognized.
- All other EBCDIC characters are accepted by the entry station and converted to blanks by the Series/1.
- Cards are inserted face up, column-1 edge first.
- Upper left and upper right corner cuts are permitted.
- External scores System/3-1 (bottom edge) and System/3-3 (column-32 edge) are permitted.
- Left and right edge continuous forms scores are permitted.
- Standard DP-7 point, heavy duty card stock, DP-9 point, and super stock cards are permitted.
- Merchandise tags, with or without upper right score or hole, are permitted.

80-column cards

- Columns 1–64 can be read.
- A 64-character set, including blanks, is recognized.
- All other EBCDIC characters are accepted by the entry station and converted to blanks by the Series/1.
- Upper left and upper right corner cuts (C1, C2, C3) are permitted.
- Cards are inserted face up, column-80 edge first.
- External scores (column-1 end only) M-3, M-4, M-5 (with nominal specified card length present in row "6" area), M-6, M-7, 0M-2, CF-4, and CF-11 are permitted.
- External scores are not permitted on column-80 edge of card.
- Internal scores M-3, M-4, and M-5 are permitted.
- Standard DP-7 point, heavy-duty card stock, DP-9 point, super stock, and port-a-punch cards are permitted.

Chapter 2. Input/Output Operations—Commands, Status, and Resets

This chapter describes the I/O commands, control words, and operations that the processor uses to transfer data to and from the attachment. This chapter also describes the Operate I/O instruction, its associated commands, status words, and condition codes, and the immediate device control block (IDCB) and device control block (DCB).

The Series/1 Data Collection Interactive attachment cards plug into adjacent Series/1 I/O slots on the Series/1 processor, or IBM 4959 Input/Output Expansion Unit. The attachment handles all the data transfers between the Series/1 and the loop.

Series/1 I/O Addressing

The attachment responds to one of two Series/1 device addresses. There must be a unique Series/1 address for each master scheduler card. Bits 9–15 of the device address field in the IDCB specify the device address; bit 8 of the device address field must be 0. This allows the Data Collection Interactive attachment 128 possible device address combinations. Bits 9–15 of the device address are jumper selectable on the master scheduler cards. For example, 27 (hex) could be the address for the first master scheduler card; then, 28 (hex) would be the address for the second master scheduler card. The individual loop is specified in the DCB.

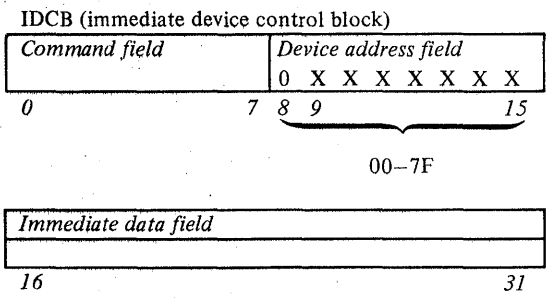
Operate I/O (IO) Instruction

The Operate I/O instruction is used by the Series/1 processor to initiate I/O operations in the Series/1 section of the attachment. The Operate I/O instruction generates an effective address that points to an immediate device control block (IDCB) in processor storage. The IDCB consists of two words that contain an I/O command, a device address (the attachment address), and an immediate data field. For DPC operations, the immediate data field is used as a device data word. For cycle-steal operations, the immediate data field points to a device control block (DCB) that provides additional information needed for the operation.

The IDCB and the DCB are explained in the following paragraphs. For more details of the Operate I/O Instruction, refer to the appropriate Series/1 processor description manual.

Immediate Device Control Block (IDCB)

An IDCB is required for each Operate I/O instruction issued by the processor. The format of the IDCB is:



The fields within the IDCB must contain the proper data to initiate the required I/O operation. The immediate data field in the IDCB contains a data word, a DCB address, or 0's, depending on the I/O command. (See "Series/1 I/O Commands" in this chapter.)

Device Control Block (DCB)

A DCB, which is composed of eight contiguous words, is used for each cycle-steal operation. The DCB is pointed to by the IDCB immediate data field when a cycle-steal command is used. The commands that cause the attachment to fetch a DCB from processor storage are:

- Start
- Start Diagnostic
- Start Cycle Steal Status

The DCB must contain the proper information before it is fetched by the attachment, which uses the cycle-steal mechanism to fetch the DCB. The attachment does not use the extended DCB formats; only the standard format (as explained in this chapter) is used.

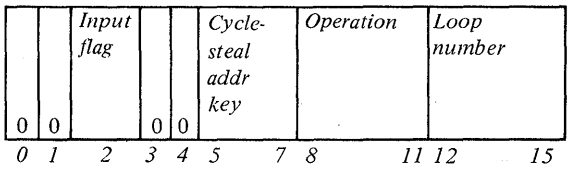
Device control block (DCB)

Word	
0	Control word
1	Device parameter 1 (DP1)
2	Device parameter 2 (DP2)
3	Device parameter 3 (DP3)
4	Device parameter 4 (DP4)
5	Device parameter 5 (DP5)
6	Byte count
7	Data address

DCB Word 0—Control Word

The format of the 16-bit control word is:

Control word format



Bit 0 — *Zero.*

Bit 1 — *Zero.*

Bit 2 — *Input Flag.* The setting of this bit informs the attachment of the direction of data transfer.

0 = output (Series/1 main storage to the attachment)

1 = input (attachment to Series/1 main storage)

Bit 3 — *Zero.*

Bit 4 — *Zero.*

Bits 5–7 — *Cycle-Steal Address Key.* This 3-bit key is presented by the attachment to the processor during data transfers. Some processors use this key as either a storage protect key or a storage access key.

Bits 8–11 — *Operation Field.* Identifies the operation to be performed.

0001	Read data
0010	Start loop
0011	Stop loop
0100	Test loop
0101	Configurate
0110	Transfer patterns
0111	Send time-of-day
1000	Send/erase message to data entry station
1001	Activate buzzer

Bits 12–15 — *Loop Number.* Identifies the loop that is to perform the operation.

0000	Select master scheduler (or send to all loops)
0001	Select loop multiplexer #1
0010	Select loop multiplexer #2
0011	Select loop multiplexer #3
0100	Select loop multiplexer #4

DCB Word 1—Device Parameter 1

Device parameter 1 is used only with the transfer patterns operation. It contains the start address within the scheduler storage or loop multiplexer storage to/from which data passes.

Scheduler addresses equal 0800–08FF (hex). Loop multiplexer addresses equal 0C00–0CAF (hex).

An address outside these ranges for a write transfer patterns operation results in an exception interrupt with a DCB specification check set in the ISB.

DCB Word 2—Device Parameter 2

Device parameter 2 is used only with the configurate operation. The high-order digit contains the record type to be sent. The record type can be either 1, 4, or 5. Any other record type results in an exception interrupt with a DCB specification check set in the ISB.

DCB Word 3—Device Parameter 3

Device parameter 3 is used to hold two bytes of data for a transfer patterns operation to a specific loop multiplexer. It is also used to specify the data entry station in EBCDIC, in bits 8–15, when sending a message to a specific data entry station on a loop.

Bit 0 is used to indicate if this is a send message or erase message operation.

Bit 0 = 0—send message
Bit 0 = 1—erase message

This parameter is also used to specify the data entry station address for an activate buzzer operation. For this operation, bit 0 is ignored.

DCB Word 4—Device Parameter 4

Device parameter 4 is used in conjunction with the send time-of-day operation defined in the control word.

DHHF

D: Day of week (1 through 7)
HH: Hour of day (continental time 00–23) *or*
Hour of day (standard time 01–12)
F: 0 if HH is continental time *or*
1 if HH is standard time (AM) *or*
2 if HH is standard time (PM)

If a value outside these ranges is used or a mismatch of "HH' and "F" parameters exists, an exception interrupt occurs with a DCB specification check in the interrupt status byte (ISB).

DCB Word 5—Device Parameter 5

Device parameter 5 is used in conjunction with the send time-of-day operation defined in the control word.

MM00 MM: Minutes 00–59

If a value outside this range is used, an exception interrupt occurs with a DCB specification check in the ISB.

DCB Word 6—Byte Count

This word contains the number of bytes of data to be transferred. (This must be an even number of bytes of data.) If an odd byte count is specified, an exception interrupt occurs with a DCB specification check in the ISB.

Byte count is used in conjunction with read data, configurate, transfer patterns, and send message operations.

DCB Word 7—Data Address

This word contains the starting data address in Series/1 main storage for read, write, or diagnostic operations. This address must point to an even word boundary. If the address is odd, an exception interrupt occurs with a DCB specification check in the ISB.

Data address is used in conjunction with read data, configurate, transfer patterns, and send message operations.

Series/1 I/O Commands

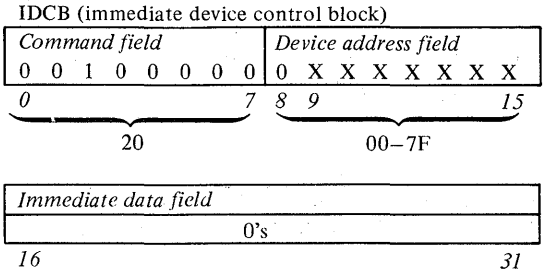
This section describes the Series/1 I/O commands that are used by the attachment. The status information that is presented to the Series/1 processor by the attachment for each I/O command is explained later in this chapter.

The attachment responds to the following I/O commands from the Series/1 processor:

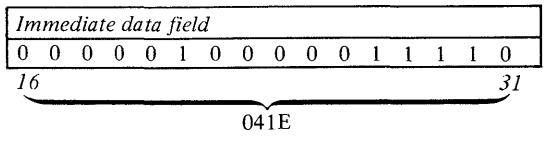
Command code (hexadecimal)	Command name
20	Read ID
60	Prepare
6F	Device Reset
70	Start
7D	Start Diagnostic
7F	Start Cycle Steal Status
F0	Halt I/O

Read ID

The Read ID command transfers the device ID word from the attachment to the immediate data field of the IDCB in Series/1 main storage.



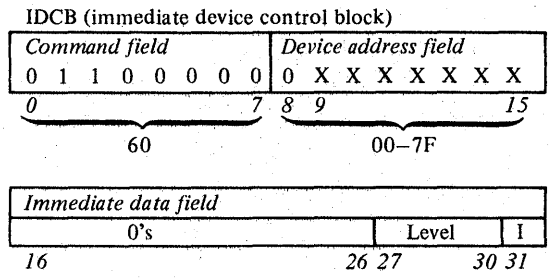
After execution of the Read ID command, the immediate data field of the IDCB contains:



The device ID for both RPQ D02312 and RPQ D02314 is 041E (hex). RPQ D02313 does not respond to I/O channel commands.

Prepare

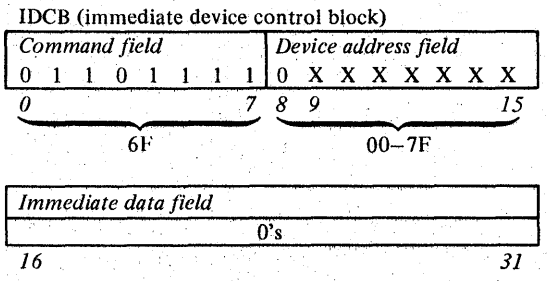
The Prepare command transfers the IDCB data word to the prepare register in the attachment. The binary value of the level field (bits 27–30) is used to assign a priority interrupt level to the attachment. (For example, 0000 = level 0, 0001 = level 1, 0010 = level 2, and 0011 = level 3.) The I-bit (bit 31) is a device interrupt mask. If the I-bit equals 1, the attachment can interrupt the Series/1 processor; if the I-bit equals 0, the attachment cannot interrupt.



Note: The IBM 4952, 4953, and 4955 Processors do not recognize a priority level other than 0–3. If a device is prepared for a level other than 0–3, the interrupt is lost.

Device Reset

The Device Reset command causes all controls, status, and pending interrupts in the Series/1 Data Collection Interactive attachment to be reset. The prepare register is *not* reset. Bits 16–31 of the IDCB are unused, and should be set to 0's to avoid future code obsolescence.

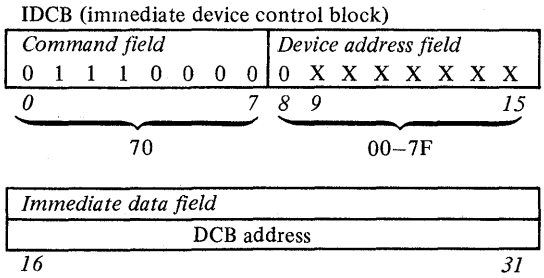


Start

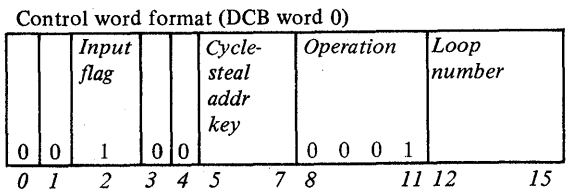
The Start command initiates a cycle-steal operation between the attachment and the Series/1 processor. The second word of the start command's IDCB must contain a 16-bit main storage address of the DCB. The DCB is fetched by the attachment and contains additional information about the type of operation to be performed.

Bits 8–11 of DCB word 0 identify the operation to be performed. Each operation is explained in the following paragraphs.

Refer to "Device Control Block (DCB)" in this chapter for the format of the DCB and the DCB control word.



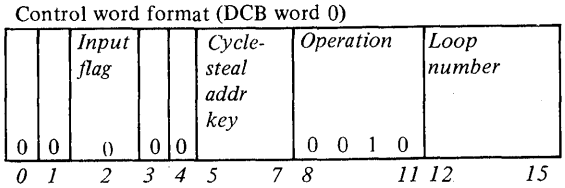
Read Data Operation



The read data operation transfers data buffers or badge buffers from the master scheduler to the Series/1. The master scheduler receives data from loop multiplexers into four buffers (one per loop). When a complete buffer has been received, the attachment generates an attention interrupt to the processor. A read data operation then causes the buffer to be transferred to Series/1 main storage on a first-in, first-out basis. If this operation is specified, without receiving an attention interrupt, an exception interrupt occurs, with bit 0 set in the ISB.

Start Loop Operation

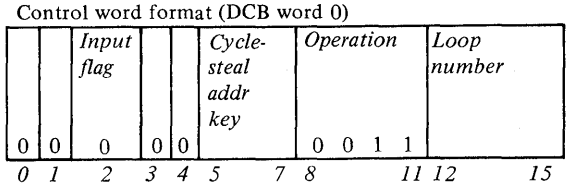
Control word format (DCB word 0)



The start loop operation causes the loop, specified in bits 12–15 of the DCB control word, to start normal operations. If bits 12–15 are 0's, all loops are started.

Stop Loop Operation

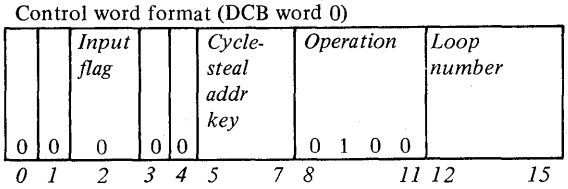
Control word format (DCB word 0)



The stop loop operation causes the loop, specified in bits 12–15 of the DCB control word, to stop operations. If bits 12–15 are 0's, a DCB specification check occurs.

Test Loop Operation

Control word format (DCB word 0)



The test loop operation causes a test to be run on the loop multiplexer defined in bits 12–15 of the DCB control word. If bits 12–15 are 0's, an exception interrupt occurs, with a DCB specification check in the ISB.

To execute this command properly, the selected loop must be in a *stopped* state, and all entry stations on that loop must be bypassed. If both of these conditions do not exist, an exception interrupt occurs, with bit 0 set in the ISB.

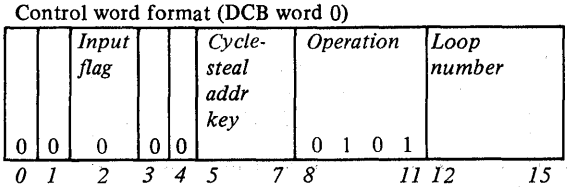
To test the loop multiplexer in wrap mode, a test loop operation is used in conjunction with the "Problem Determination Guide," reverse key ❿, in Chapter 4.

The test loop operation is performed after the Loop Wrap Fixture, part number 6840607, is installed on the loop multiplexer in place of the loop cable.

The test loop operation checks the driver and receiver circuits on the loop multiplexer card to determine if the problem is on the loop or in the loop multiplexer card.

Configurate Operation

Control word format (DCB word 0)

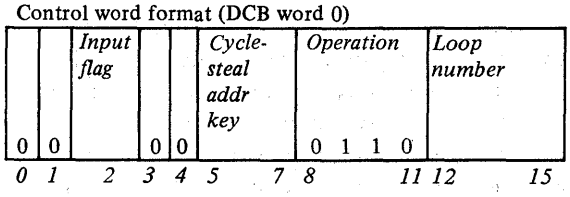


The configurate operation causes a definition record to be transferred to the attachment. The master scheduler passes the record to the appropriate loop multiplexer.

For an explanation of definition records, see Appendix A, "Personalization."

Transfer Patterns Operation

Control word format (DCB word 0)

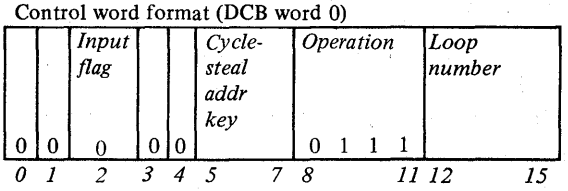


The transfer patterns operation causes data to be transferred between Series/1 main storage and the storage contained in the loop multiplexer specified by bits 12–15 of the DCB control word. If bits 12–15 are 0's, transfer takes place between Series/1 main storage and the master scheduler storage.

When transferring data to a loop multiplexer, only two bytes, which are contained in device parameter 3 of the DCB, can be transferred. When transferring data to the master scheduler, device parameter 3 of the DCB is not used, and a byte count and data address must be specified in DCB words 6 and 7.

Send Time-of-Day Operation

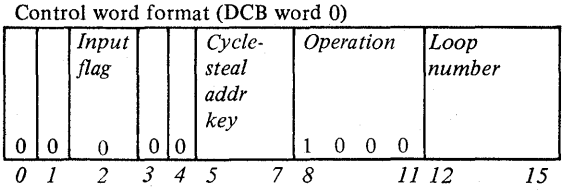
Control word format (DCB word 0)



The send time-of-day operation causes the hour, minute, and day to be transferred to the master scheduler for loop station displays. The day-of-week is not displayed, but is included in the header of a data record or a badge record that is passed to the processor. Once the master scheduler is initialized, it tracks and updates the time-of-day.

Send/Erase Message to Data Entry Station Operation

Control word format (DCB word 0)



The send/erase message to data entry station operation causes a message of 1–8 characters to be displayed on a data entry station. These characters can be either numeric (0–9) or alpha. (Not all alpha characters can be used.) The entry station attached to the loop is specified in device parameter 3 of the DCB; the loop is specified in bits 12–15 of the DCB control word. If a loop is specified in device parameter 3, but no entry station is specified, all entry stations on that loop are addressed. If bits 12–15 of the DCB control word are 0's, the message is sent to all data entry stations attached to one master scheduler.

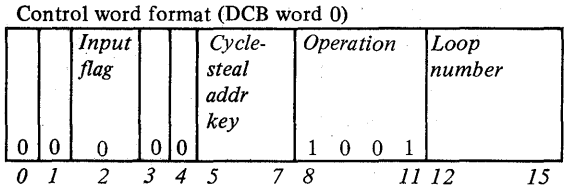
The message is displayed until either another message is displayed or an erase message operation occurs. The byte count and data address of the message must be specified in the DCB.

This operation must be preceded by a start loop operation; otherwise, an exception interrupt occurs with bit 0 set in the ISB. However, this message is sent to all previously started loops and no error is indicated for a stopped loop.

See Appendix B for additional information about the data message format.

Activate Buzzer Operation

Control word format (DCB word 0)



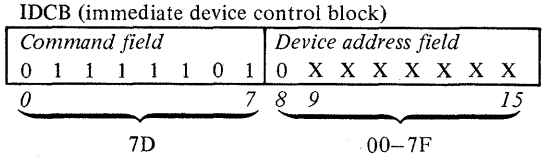
The activate buzzer operation activates a buzzer (if one is installed) in the entry unit specified in device parameter 3 of the DCB. The loop is specified in bits 12–15 of the DCB control word. If bits 12–15 of the DCB control word are 0's, the buzzers in all the entry stations attached to a master scheduler are activated.

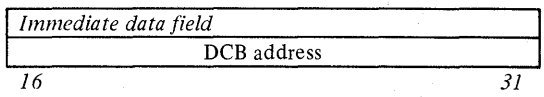
This operation must be preceded by a start loop operation; otherwise, an exception interrupt occurs with bit 0 set in the ISB. However, all buzzers are activated on previously started loops and no error is indicated for a stopped loop.

Start Diagnostic

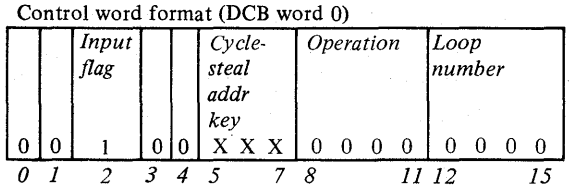
The Start Diagnostic command is used to test internal operations in the attachment. This command uses only the cycle-steal address key of the control word, byte count, and the data address in the DCB. Byte count must be 16; if it is not, a DCB specification check occurs in the ISB. The unused bits in the control word of the DCB are not checked, and should be set to 0's.

IDCB (immediate device control block)





Control word format (DCB word 0)



Two groups of tests are performed: one before the DCB is fetched and one after the DCB is fetched.

When the attachment receives the Start Diagnostic command, it immediately performs the first group of tests.

When these tests are completed, the attachment then fetches the DCB. The remaining tests consist of a data wrap test associated with the 'data bus out' and 'data bus in' lines, and a parity check of those buses.

Test results, consisting of eight status words, are returned to the Series/1 at the end of the operation. DCB word 7 specifies the starting main storage address for these status words:

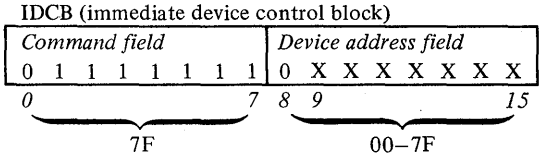
Word 1	Checksum A (known value)
Word 2	Checksum A (actual value—complemented)
Word 3	Checksum B (known value)
Word 4	Checksum B (actual value—complemented)
Word 5	Checksum C (known value)
Word 6	Checksum C (actual value—complemented)
Word 7	Scheduler storage test results A hex value of 0000 indicates that all tests were successful; any other value indicates a test failure.
Word 8	Device test results A hex value of 0F00 indicates all tests were successful; any other value indicates a test failure.

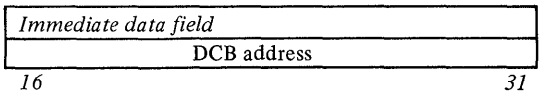
Start Cycle Steal Status

The Start Cycle Steal Status command initiates a cycle-steal operation that transfers four bytes (two words) of data from the attachment to main storage. This command uses only the cycle-steal address key of the control word, the byte count, and the data address in the DCB. The unused bits in the control word are not checked, and should be set to 0's. The byte count (DCB word 6) must specify a count of 4; otherwise, a DCB specification check occurs in the ISB. The data address (DCB word 7) specifies the starting main storage address for the data.

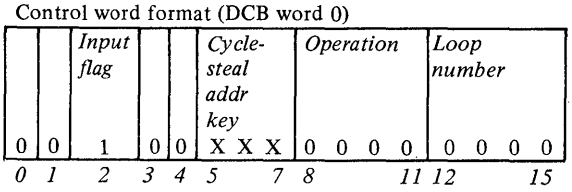
Refer to "Cycle-Steal Status Words" in this chapter for a description of the four bytes of data.

IDCB (immediate device control block)





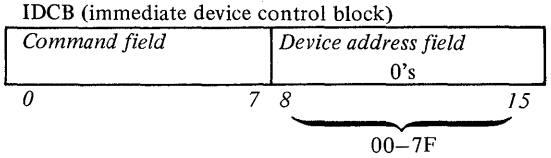
Control word format (DCB word 0)

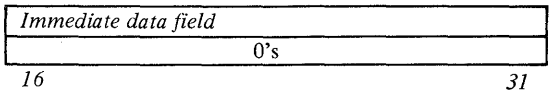


Halt I/O

The Halt I/O command, which is directed to the Series/1 channel, causes a halt of all I/O activity on the channel and resets any pending interrupts. The prepare register in the attachment is not reset. Bits 8–31 of the IDCB are not used, and should be set to 0's.

IDCB (immediate device control block)





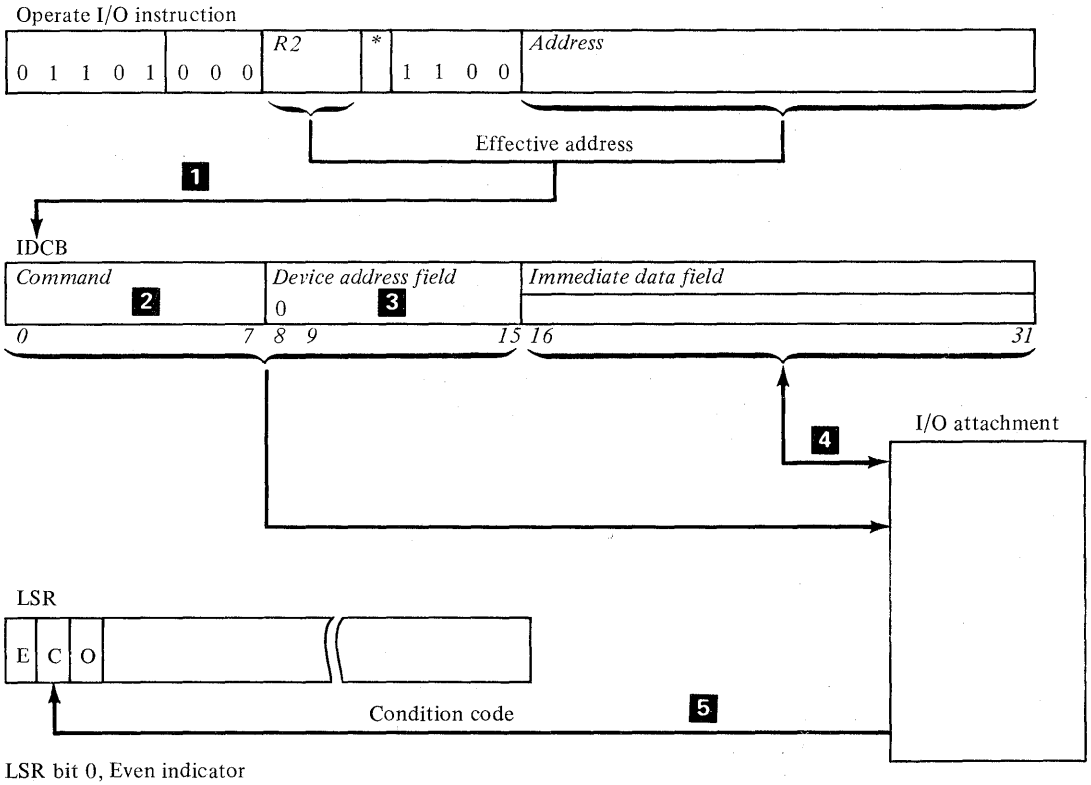
Direct Program Control (DPC) Operation

A command executed under direct program control causes an immediate transfer of data or control information to or from the attachment. The Data Collection Interactive attachment recognizes only the following DPC-type commands:

Command	Hex	IDCB immediate data field contents
Read ID	20	Device ID word
Prepare	60	Interrupt parameters
Device Reset	6F	Zeros

An Operate I/O instruction must be executed for each of the preceding commands. Each operation consists of the following events (see Figure 2-1):

1. The Operate I/O instruction points to an IDCB in main storage 1.
2. The I/O channel uses the IDCB's device address field 3 to select the device, and the command field 2 to determine the operation to perform.
3. The processor transfers the contents of the immediate data field to the attachment, or transfers information from the attachment to the immediate data field, depending on the command being executed 4.
4. The attachment sends a condition code to the level status register (LSR) in the processor 5.



LSR bit 0, Even indicator
LSR bit 1, Carry indicator
LSR bit 2, Overflow indicator

*Indirect address bit

Figure 2-1. Direct program control I/O operation

Cycle-Steal Operation

Command execution in cycle-steal mode permits overlapping of I/O operations with other processor operations. The processor transfers the IDCB under DPC from processor storage to the attachment (see Figure 2-2, 1). After the attachment accepts the IDCB:

1. It returns an Operate I/O condition code to the processor 2. The processor is now free to continue with other operations.
2. The attachment uses the information in the IDCB to execute the command. The IDCB immediate data field contains the address of an 8-word DCB defining the operation.
3. The attachment cycle-steals the DCB words 3 and data 4 needed to perform the command.
4. Each data transfer reduces a preset byte count in DCB word 6.
5. When the data transfer ends (byte count equals 0), the attachment sends an interrupt request to the processor.

The processor then accepts the interrupt condition code and an interrupt ID word from the attachment.

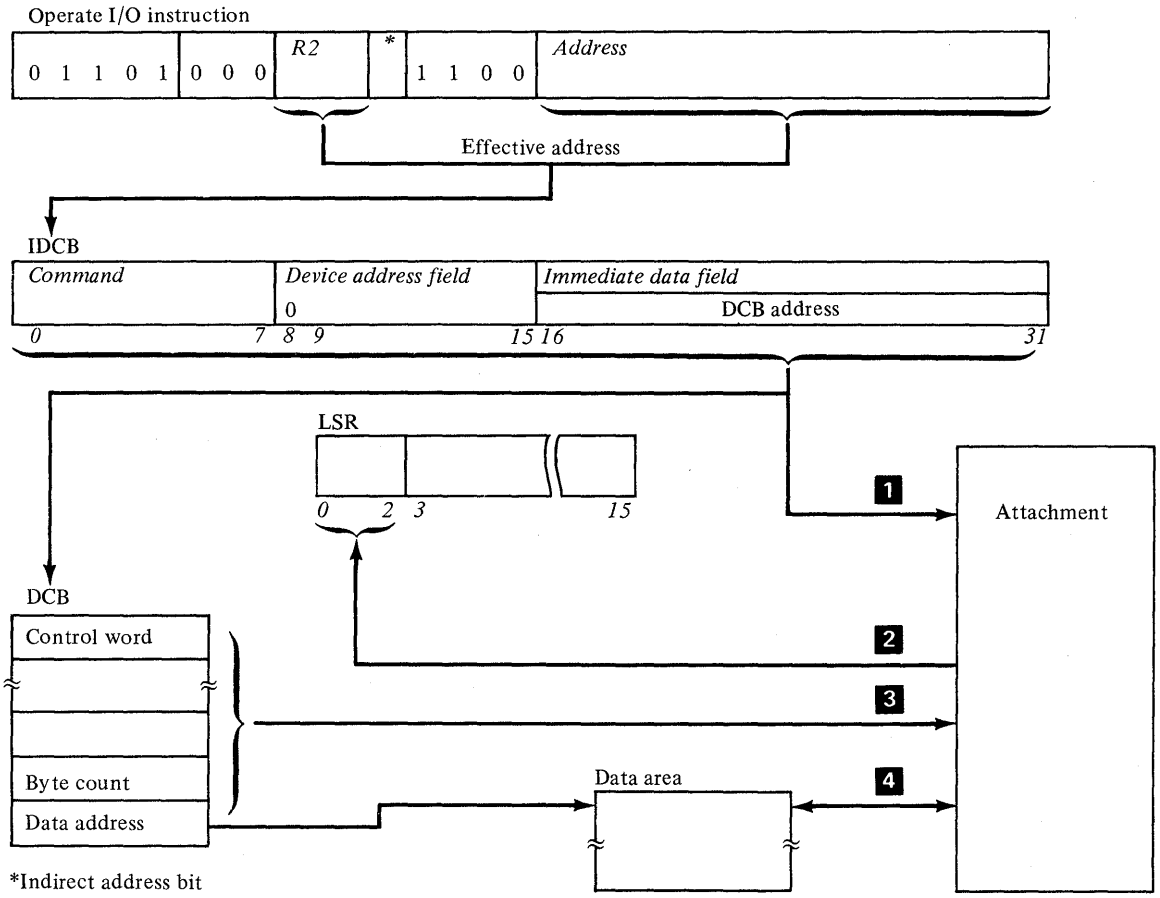


Figure 2-2. Cycle steal operation

Series/1 Status Information

This section describes the status information that is presented to the Series/1 processor by the attachment, as follows:

- Condition codes
- Interrupt ID word
- Cycle-steal status words

Condition Codes

Two types of condition codes are reported to the Series/1 by the attachment: Operate I/O instruction condition codes and interrupt condition codes.

Operate I/O Instruction Condition Codes

Condition codes are reported after execution of each Operate I/O instruction (see Figure 2-3). The appropriate condition code is transferred into the even, carry, and overflow bit positions of the LSR in the processor.

Command	CC0	CC1	CC2	CC3	CC4	CC5	CC6	CC7
Read ID	X	X	X			X		X
Prepare	X					X		X
Device Reset	X							X
Start	X	X	X	X		X		X
Start Cycle Steal Status	X	X	X			X		X
Start Diagnostic	X	X	X			X		X
Halt I/O*								X

*Channel-directed command
X = condition code reported

CC Value	Meaning
0	Device not attached
1	Busy
2	Busy after reset
3	Command reject
5	Interface data check
7	Satisfactory

Figure 2-3. Condition code responses to Operate I/O instructions

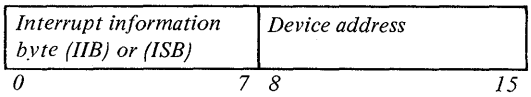
Interrupt Condition Codes

Interrupt condition codes pertain to (1) operations that continue beyond execution of the Operate I/O instruction (such as cycle-stealing of data), and (2) asynchronous events that occur. The condition codes that are reported are:

CC value	Meaning
2	Exception
3	Device end
4	Attention
6	Attention and exception
7	Attention and device end

Interrupt ID Word

Along with the interrupt condition code, the attachment also transfers an interrupt ID word to the processor. Bits 0–7 of the interrupt ID word are called the interrupt information byte (IIB) or interrupt status byte (ISB), depending on the condition code; bits 8–15 are the device address.



Interrupt Information Byte (IIB)

The interrupt information byte (IIB) is 0 for all condition codes except CC2 and CC6. When these exception interrupts occur, the IIB is called an interrupt status byte (ISB).

Interrupt Status Byte (ISB)

For interrupt condition code 2 or 6, the IIB has a special format and is called an ISB. The ISB is coded as follows:

Bit 0 *Device-Dependent Status Available.* When set to 1, this bit signifies that further status is available. This status is obtained using the Start Cycle Steal Status command.

Bit 1 *Delayed Command Reject.* This bit is set to 1 if the device cannot execute the command due to one of the following conditions:

1. The IDCB contains an incorrect parameter. Examples are:
   a. An odd-byte DCB address
   b. An incorrect function/modifier combination

2. The present state of the device, such as a not-ready condition, prevents execution of an I/O command specified in the IDCB.

Delayed command reject is set in the ISB only if the device cannot report an appropriate I/O instruction condition code for the condition. The operation is terminated, and the DCB is not fetched.

Bit 2 *Not Reported.*

Bit 3 *DCB Specification Check.* This bit is set to 1 when the device cannot execute a command due to an incorrect parameter specification in the DCB. Examples are:

1. An odd-byte DCB address
2. An invalid command or invalid bit settings in the control word

The operation is terminated.

Bit 4 *Storage Data Check.* This error condition applies to cycle-steal output operations only. If the bit is set to 1, it indicates that the main storage location accessed during the current output cycle contained bad parity. Parity in main storage is not corrected. The attachment terminates the operation. The bad parity data is not transferred to the I/O data bus, and no machine-check condition occurs.

Bit 5 *Invalid Storage Address.* When set to 1, this bit indicates that, during a cycle-steal operation, the attachment has presented a main storage address that is outside the storage size of the system. The operation is terminated immediately.

Bit 6 *Protect Check.* When set to 1, this bit indicates that the attachment attempted to access a main storage location and presented an incorrect address key.

Bit 7 *Interface Data Check.* When set to 1, this bit indicates that a parity error is detected on the I/O interface during a cycle-steal data transfer. The operation is terminated immediately.

Cycle-Steal Status Words

Two status words (four bytes) are transferred to the Series/1 processor when a Start Cycle Steal Status command is executed.

Word 0 Residual address
Word 1 Data collection interactive status message

These status words indicate the condition of the attachment at the time of the most recent interrupt prior to issuing the Start Cycle Steal Status command.

Residual Address

This is the main storage address of the last attempted cycle-steal transfer associated with a Start command or a Start Diagnostic command. The residual address can be either a data address or a DCB address. Execution of a Start Cycle Steal Status command does not alter this address, which is set to 0001 (hex) by a power-on reset.

Status Messages

There are two types of status messages: loop status messages and configuration status messages. A loop status message is returned when a loop error has been detected. A configuration status message is returned when a definition record error has been detected.

Loop status messages have the following format:

LEXX where L = failing loop multiplexer number
E = error
XX = error code

Loop Status Messages

Error code	Type of error
01	Loop multiplexer error
02	Internal interface checksum error
03	Internal interface message count error
04	No response to message sent
05	Loop off-line
06	Loop busy
07	Timer error
08	Loop stopped
09	Read Data command not in response to an attention interrupt
10	Open loop
11	Sync sequence error on loop
12	Loop resync complete
13	Station address error
14	Loop wrap failure
28	Loop not in stop mode for loop wrap test

Programming Considerations

When operating in interactive mode (sending messages to data entry stations), both the in process (yellow light) and the ready (green) indicators remain lit at the end of the first transaction following the display of a message, if the following are not adhered to:

- If no message is to be displayed after a transaction is complete, perform an erase operation to the entry station that sent the transaction.
- If a message is to be displayed after a transaction is complete, precede that message with an erase operation.

Normal operation is not impacted.

Configuration status messages have the following format:

93XX where XX = error code

Configuration Status Messages

Error code	Type of error
01	Invalid definition record code, other than 1, 4, or 5
02	Invalid loop ID, error in definition record 1, 4, or 5
03	Number of badges defined improperly in definition record 4
04	Number of key fields defined improperly in definition record 4
05	Number of cards defined improperly in definition record 4

Chapter 3. Physical Planning and Installation

System Planning

This chapter presents all the physical planning information necessary to install loops and entry stations.

Installation Schedule of Events

The smoothness of the installation depends on a realistic installation schedule of events. The schedule of events is shown in Figure 3-1, with the responsibilities clearly indicated. There are two copies of this schedule: Copy 1—this is your copy and remains in this chapter; copy 2—this copy is in Appendix D and should be removed and given to your IBM sales representative.

A key requirement for a smooth installation is for your company to name one person as "project leader" to work with your IBM sales representative from the start.

Schedule of events

Week	Actual schedule dates	Responsibility		Date complete	Event
		Customer	IBM		
12	———	X		———	• Identify specific customer project leader responsible for all phases of the Series/1 Data Collection Interactive installation schedule.
		X		———	• Decide who will physically install the loop wiring, value read wiring, station connectors, loop connectors, station mounting brackets, value read module mounting brackets, and ac power (maintenance personnel or contractor).
		X	X	———	• Fill in "actual schedule dates" on this form and give copy to IBM representative.
				———	• Identify value read requirements (if applicable). Contact supplier of external devices (scales, counters, etc.). External devices ordered as required.
		X		———	• Identify and schedule data communications needs. Source for data link identified (telephone company contacted). Modems ordered as required.
		X		———	• Finalize floor plan layout using the plan views in Chapter 3. Show location of Series/1, all entry stations, value read modules, and wiring.
		X		———	• Confirm sufficient quantities of accessories are ordered.
11	———	X	X	———	• Contact by IBM representative resulting in joint agreement in overall installation plan.
10	———	X		———	• Place order for supplies listed in Appendix C.
9		X		———	• Release purchase order or work order for physical installation of mounting brackets, station connectors, loop cabling, and ac power.
		X		———	• Define training program for employees and supervisors.
7		X	X	———	• Review Installation Plan to define any exposures to schedule.
		X	X	———	• Confirm on-site arrival of IBM accessory package containing station connectors, mounting brackets, cables, etc.
		X		———	• Start installation of mounting brackets, cabling, and power receptacles.

Figure 3-1 (Part 1 of 2). Installation schedule of events

Schedule of events (continued)

Week	Actual schedule dates	Responsibility		Date complete	Event
		Customer	IBM		
5	———	X		———	• Begin supervisor training.
			X		• Contact by IBM sales representative to check progress of physical installation.
4	———	X		———	• Prepare entry station action cards.
		X		———	• Define employee instruction procedures.
		X		———	• Supplies (cards, badges, etc.) received.
3	———	X		———	• Complete physical installation of mounting brackets, value read external device, cabling, power receptacles, and station connectors.
2	———	X		———	• Complete checkout of physical installation, i.e., continuity and polarity tests of loop interconnections, physical checks of mounting brackets, power receptacles, safety considerations, external alarm, etc.
		X		———	• Physical installation complete.
1	———		X	———	• Series/1, entry stations, associated equipment arrive on site.
		X		———	• Series/1 Data Collection Interactive hardware moved to locations. Entry stations and value read modules hung on brackets, plugged in to power receptacles and station connectors.
0		X	X	———	• IBM Customer Engineer on site, powers up and checks out Series/1. Plugs in loop connectors.
		X	X	———	• System turned over to customer.
		X		———	• Check out entry station operation.
		X		———	• Supervisor employee training sessions held.

Figure 3-1 (Part 2 of 2). Installation schedule of events

Central Facilities Maintenance

Planning considerations for your Central Facilities Maintenance area (Figure 3-2) are:

- A work surface near the Series/1 for servicing entry stations. This surface must be within 4.9 m (16 ft) of the rear of the Series/1. The minimum work surface size is 0.6 m by 1.2 m (2 ft by 4 ft) and the surface must be electrically nonconductive.
- A 115-Vac, 15-ampere duplex grounding outlet *non-locking* receptacle (NEMA 5–15R) within 1.5 m (5 ft) of the work surface, to plug in test equipment.
- A 115-Vac, 15-ampere grounding outlet *locking* receptacle (NEMA L5–15R) within 1.5 m (5 ft) of the work surface, to plug in entry stations.
- A 115-Vac, 15-ampere grounding outlet *locking* receptacle (NEMA L5–15R) within 1.5 m (5 ft) of the working surface, to plug in the value read module.
- These outlets must have a third-wire grounding conductor.
- Loop 1 station connector
- Storage space for the supplies needed to operate your Series/1 Data Collection Interactive.

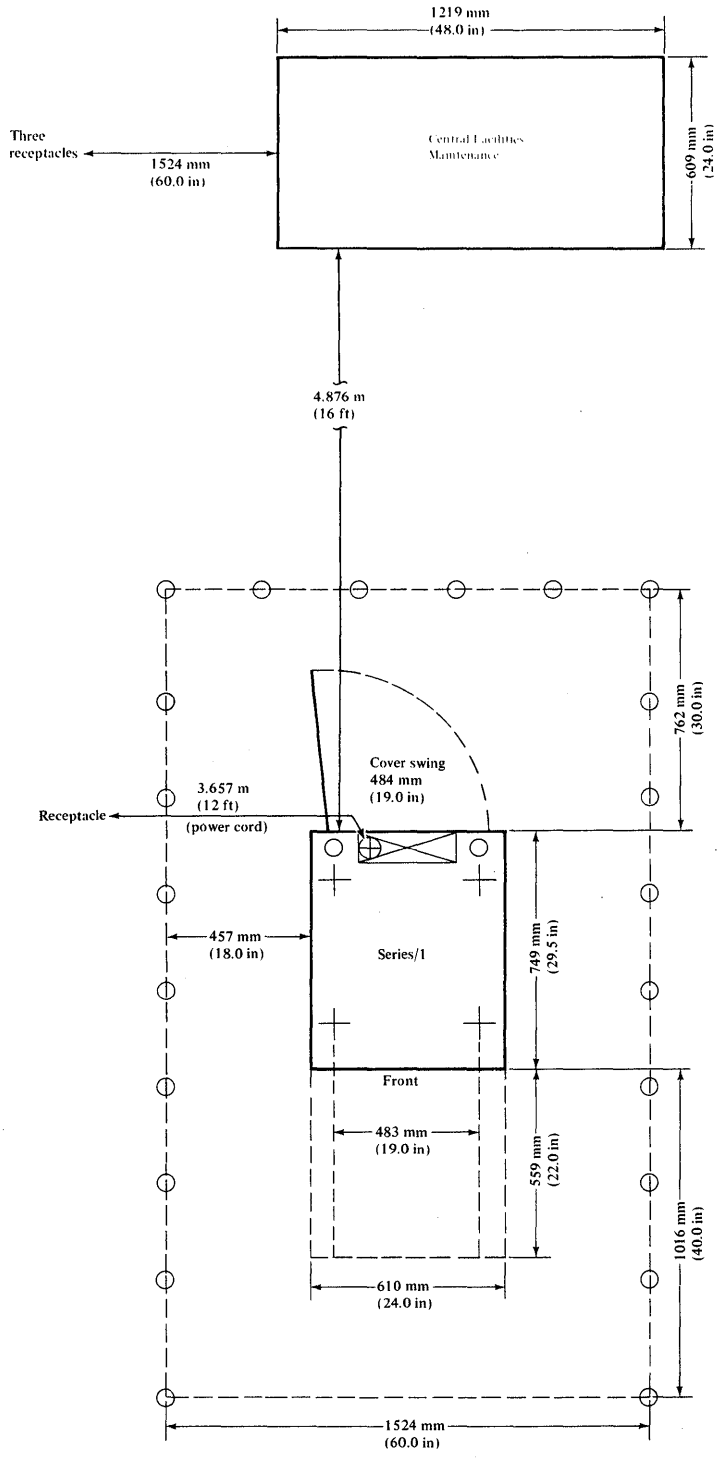


Figure 3-2. Sample floor plan for Series/1 and Central Facilities Maintenance area

5235 Data Entry Station Features and Specifications

Features (see Figure 3-3)

- Wall or pedestal mounting
- Attaches to Series/1 loops with a station connector
- Numeric keyboard
- Eight-digit display

Options

- Card input
- Badge input
- Value read attachment
- Audible indicator
- Contacts closure

The 5235 Data Entry Station is recommended for use in the "non-office" environment, but may be used in the office environment.

Consult your IBM representative to ensure that the 5235 is suitable to your particular environment.

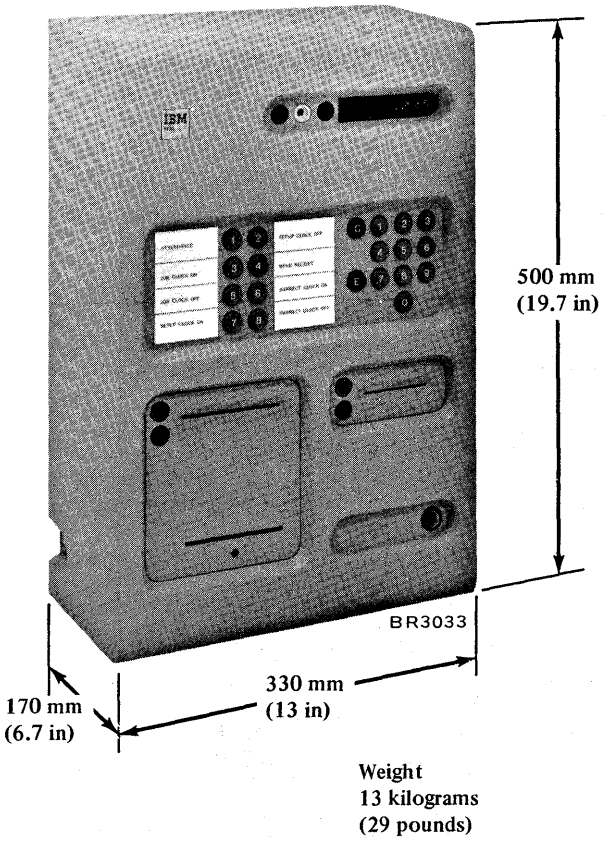


Figure 3-3. 5235 Data Entry Station

Specifications

Environment 5235:

Relative humidity	8% to 80%	8% to 80%
Wet bulb	27°C, maximum	80°F, maximum
Operating temperature	4°C to 45°C	40°F to 113°F
Nonoperating temperature	4°C to 51.7°C (See Note 1)	40°F to 125°F
Maximum operating altitude:		2100 meters (7000 ft) above sea level

Cables:

Power	1.8 m	(6 ft)
Station	1.2 m	(4 ft)
Contacts closure	1.8 m	(6 ft)
Value read	1.8 m	(6 ft)

Power-cord plugs and receptacles (locking-type only):

Plug	(NEMA L5–15P) (See Notes 2–5)	
Receptacle (single)	NEMA L5–15R	
Connector	NEMA	
Power requirements:	**60±0.5 Hz**	**50±0.5 Hz**
Volts ac (±10%)		
USA and Canada	115	
Outside USA and Canada	100/115/200 208/230	100/110/123.5/ 200/220/235
kVA	0.1	0.1
Phase	1	1
Wires	3	3
Branch circuit	15 amperes (maximum capacity)	
Heat output per hour	50 watts	170 BTU
Airflow/min	Convection only	

Notes:

1. RPQ D07006 is available to extend the low-temperature range to −18°C (0°F) for all input media, except cards.
2. Cords are provided with plugs that conform to National Electrical Manufacturer's Association (NEMA) specifications in the USA and Canada. For other countries, cords are shipped without plugs.
3. USA and Canada plugs are 115-Vac, 15-ampere, 1-phase, 3-wire, locking type.
4. The wires in the 5235 power cord include one insulated grounding conductor (green or green with yellow trace).
5. The 5235 Data Entry Station requires an insulated third-wire grounding conductor equal in size to the conductors in the branch circuit. The grounding conductor must be connected to a service ground or suitable ground. *This is a non-current carrying ground, and not a neutral.* Conduit must not be used as the only grounding means.

5236 Data Entry Station Features and Specifications

Features (see Figure 3-4)

- Desk or table mounting
- Attaches to Series/1 loops by means of a station connector
- Numeric keyboard
- Eight-digit display

Options

- Card input
- Badge input
- Value read attachment
- Audible indicator
- Contacts closure

The 5236 Data Entry Station was designed primarily for the "office" environment where abnormal gaseous and particulate environments are not involved. Consult your IBM representative to ensure that the 5236 is suitable to your particular environment.

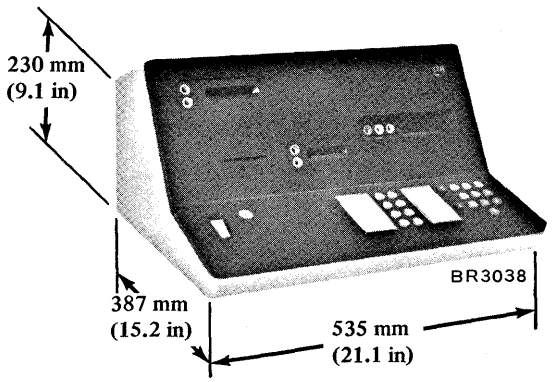


Figure 3-4. 5236 Data Entry Station

Specifications

Environment 5236:		
Relative humidity	8% to 80%	8% to 80%
Wet bulb	27°C, maximum	80°F, maximum
Operating temperature	10°C to 50°C	50°F to 105°F
Nonoperating temperature	4°C to 51.7°C	40°F to 125°F
Maximum operating altitude:		2100 meters (7000 ft) above sea level

Cables:		
Power	1.8 m	(6 ft)
Station	1.2 m	(4 ft)
Contacts closure	1.8 m	(6 ft)
Value read	1.8 m	(6 ft)

Power-cord plugs and receptacles (locking-type only):	
Plug	(NEMA L5–15P) (See Notes 1–4)
Receptacle (single)	NEMA L5–15R
Connector	NEMA

Power requirements:	**60±0.5 Hz**	**50±0.5 Hz**
Volts ac (±10%)		
USA and Canada	115	
Outside USA and Canada	100/115/200/ 208/230	100/110/123.5/ 200/220/235
kVA	0.1	0.1
Phase	1	1
Wires	3	3
Branch circuit	15 amperes (maximum capacity)	
Heat output per hour	50 watts	170 BTU
Airflow/min	Convection only	

Notes:

1. RPQ D07006 is available to extend the low-temperature range to −18°C (0°F) for all input media, except cards.
2. Cords are provided with plugs that conform to National Electrical Manufacturer's Association (NEMA) specifications in the USA and Canada. For other countries, cords are shipped without plugs.
3. USA and Canada plugs are 115-Vac, 15-ampere, 1-phase, 3-wire, locking type.
4. The wires in the 5236 power cord include one insulated grounding conductor (green or green with yellow trace).
5. The 5236 Data Entry Station requires an insulated third-wire grounding conductor equal in size to the conductors in the branch circuit. The grounding conductor must be connected to service ground or suitable ground. *This is a non-current carrying ground, and not a neutral.* Conduit must not be used as the only means of grounding.

5234 Time Entry Station Features and Specifications

Features (see Figure 3-5)

- Wall or pedestal mounting
- Attaches to Series/1 loops by means of a station connector
- Punched hole or magnetic badge reader
- Four-digit display

Options

- Audible indicator
- Contacts closure

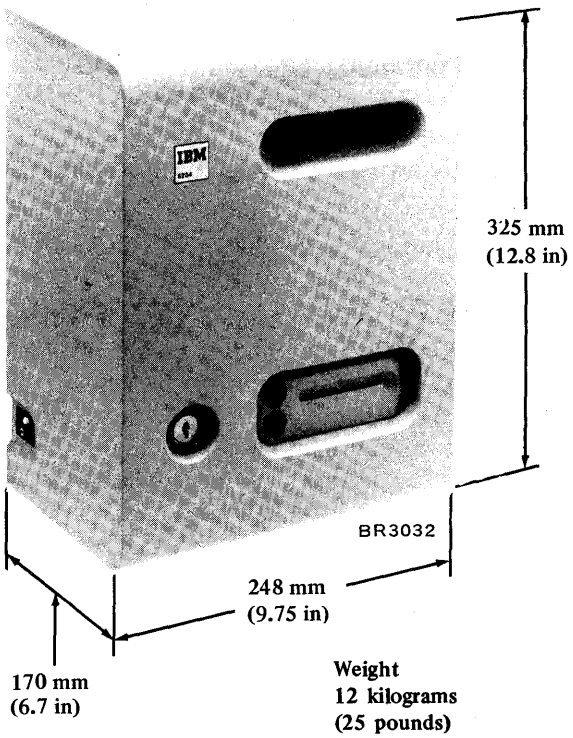


Figure 3-5. 5234 Time Entry Station

Specifications

Environment 5234:

Relative humidity	8% to 80%	8% to 80%
Wet bulb	27°C, maximum	80°F, maximum
Operating temperature	4°C to 45°C	40°F to 113°F
Nonoperating temperature	4°C to 51.7°C (See Note 1)	40°F to 125°F
Maximum operating altitude:		2100 meters (7000 ft) above sea level

Cables:

Power	1.8 m	(6 ft)
Station	1.2 m	(4 ft)
Contacts closure	1.8 m	(6 ft)

Power-cord plugs and receptacles:

	Locking
Volts	115
Plug	(NEMA L5–15P) (See Notes 2–5)
Receptacle (single)	NEMA L5–15R
Connector	NEMA

Power requirements:	**60±0.5 Hz**	**50±0.5 Hz**
Volts ac (±10%)		
USA and Canada	115	
Outside USA and Canada	100/115/200 208/230	100/110/123.5 200/220/235
kVA	0.1	0.1
Phase	1	1
Branch circuit	15 amperes (maximum capacity)	
Heat output per hour	45 watts	155 BTU
Airflow/min	Convection only	

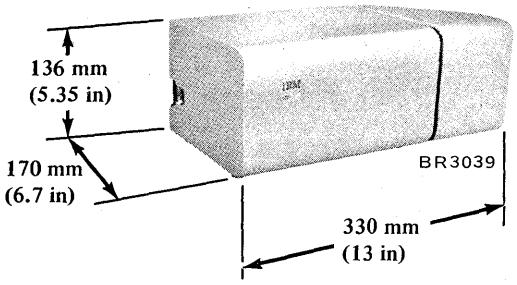
Notes:

1. RPQ D07006 is available to extend the low-temperature range to −12.2°C (10°F).
2. Cords are provided with plugs that conform to National Electrical Manufacturer's Association (NEMA) specifications in the USA and Canada. For other countries, cords are shipped without plugs.
3. USA and Canada plugs are 115-Vac, 15-ampere, 1-phase, 3-wire, locking type.
4. The wires in the 5234 power cord include one insulated grounding conductor (green or green with yellow trace).
5. The 5234 Time Entry Station requires an insulated third-wire grounding conductor equal in size to the conductors in the branch circuit. The grounding conductor must be connected to a service ground or suitable building ground. *This is a non-current carrying ground, and not a neutral.* Conduit must not be used as the only means of grounding.

5239 Value Read Module Features and Specifications

Features (see Figure 3-6)

- Wall or pedestal mounting
- Direct attachment to external devices
- Eight-digit value read
- Four selectable modes of operation
- BCD/TTL parallel input
- 1-of-10 or BCD dry contact input



Weight
5.6 kilograms
(12.5 pounds)

Figure 3-6. 5239 Value Read Module

Specifications

Environment 5239:		
Relative humidity	8% to 80%	8% to 80%
Wet bulb	27°C maximum	80°F maximum
Operating temperature	4°C to 45°C	40°F to 113°F
Nonoperating temperature	4°C to 51.7°C (See Note 1)	40°F to 125°F
Maximum operating altitude:		2100 meters (7000 ft) above sea level

Cables:		
Power	1.8 m	(6 ft)
Signal	1.8 m	(6 ft)
Control	1.8 m	(6 ft)

Power-cord plugs and receptacles:	
	Locking
Volts	115
Plug	(NEMA L5–15P) (See Notes 2–5)
Receptacle (single)	NEMA L5–15R
Connector	NEMA

Power requirements:	**60±0.5 Hz,**	**50±0.5 Hz**
Volts ac (±10%)		
USA and Canada	115	115
Outside USA and Canada	100/115/200/ 208/230	100/110/123.5/ 200/220/235
kVA	0.02	
Phase	1	1
Branch circuit	15 amperes (maximum capacity)	
Heat output per hour	20 watts	69 BTU
Air flow/min	Convection only	

Notes:

1. RPQ D07006 is available to extend the low-temperature range to −18°C (0°F).
2. Cords are provided with plugs that conform to National Electrical Manufacturer's Association (NEMA) specification in the USA and Canada. For other countries, cords are shipped without plugs.
3. USA and Canada plugs are 115-Vac, 15-ampere, 1-phase, 3-wire, locking type.
4. The wires in the 5239 power cord include one insulated grounding conductor (green or green with yellow trace).
5. The 5239 Value Read Module requires an insulated third-wire grounding conductor equal in size to the conductors in the branch circuit. The grounding conductor must be connected to service ground or suitable building ground. *This is a non-current carrying ground, and not a neutral.* Conduit must not be used as the only means of grounding.

Planning Checklists

To help you successfully plan the physical installation of your system, this section is presented in a logical step-by-step sequence. Read each step completely before finishing the operation, as indicated by □. Steps leading to the specified operations have ( ) at the beginning of the step. Some of these steps are information instructions, while others require that you perform a specific action. When you understand or complete a step, check it off. Remember, you must check off all steps preceded by ( ) before completing an operation, as specified by □.

Floor Plan

Use the physical specifications shown earlier in this chapter to make a floor plan. Determine the following:

( ) The physical location of each data entry station.

( ) The physical location of each time entry station.

( ) The physical location of each value read module, if that feature is installed.

( ) The location of an ac-power receptacle for each entry station and value read module.

( ) The location of station connectors for each entry station.

( ) The assignment to each station of a loop number and a station number.

( ) The location of contacts closure connector for each entry station with contacts closure feature.

( ) The physical layout of your Series/1 Data Collection Interactive area with provision for the Central Facilities Maintenance site. (See Figure 3-2 for a sample floor plan of the Series/1 and service area.)

( ) The location of the Central Facilities Maintenance site within 16 feet of your Series/1 Data Collection Interactive system.

□ Draw your system floor plan.

Loop Assignments

Now that you have your floor plan layout, you need to plan your loops.

( ) Each Series/1 Data Collection Interactive can operate up to eight loops.

( ) Loop 1 can only have up to three entry stations.

( ) All other loops can have up to four entry stations.

( ) Each entry station must have a power outlet within 1.5 m (5 ft).

□ Draw the location of each entry station, ac power outlet, and station connector on your system floor plan. Label each station with its address.

Loop Cable Characteristics

You are responsible for installing loop cables, in accordance with the specifications in this chapter, and complying with all local and municipal electrical and building codes. Satisfactory cable performance is vital to your system operation. IBM loop cable or equivalent, which must be used, is supplied on 152-m (500-ft) and 305-m (1000-ft) spools.

The general characteristics of this loop cable for determining ease of installation and proper routing are:

- Shielded twisted pair, 20 AWG, with shield drain wire
- PVC insulation, outer diameter 6 mm (0.25 in)
- Temperature rating: −40°C (−40°F) to +80°C (176°F)

These general characteristics are not sufficient to determine equivalent loop cable if you choose not to use IBM cable. You must adhere to Series/1 Data Collection Interactive loop cable specifications, which may be obtained through your IBM representative.

Electrical and Electromagnetic Noise

Caution must be exercised in locating cables near electrical power equipment and lighting fixtures that may cause electrical interference (noise) on the loops.

Check for the following electrical and electromagnetic noise sources:

( ) Fluorescent, neon, and incandescent lighting fixtures

( ) Power distribution, including wiring, transformers, generators, and alternators

( ) Motors that drive machinery, such as air conditioners, elevators, escalators, large blowers, and machine tools

( ) Radio and television transmitters

( ) Signal generators, intercommunication systems, and security signal systems

( ) Arc welders, electro-discharge machines, and related equipment

Preventing Electrical and Electromagnetic Noise

Interference between loop cable and typical sources of electrical interference apply generally to long parallel runs. Good rules to follow for noise prevention are:

( ) All loop cabling should be kept at least 0.3 m (1 ft) away from any power line or source voltage in excess of 220 volts at a load of 5 kVA or less, and at least 0.6 m (2 ft) away if the load exceeds 5 kVA. Loads of 10 to 15 kVA require a separation of 1.5 m (5 ft).

( ) Unshielded high energy or high power sources may require more separation; for these cases, contact your IBM Installation Planning Representative.

( ) If necessary, loop cabling may be tied to grounded power conduits, providing:

- The voltage is less than 250 volts
- The power line is in grounded conduit
- No parallel run in excess of 15 m (50 ft) is tied to the conduit

Grounding the Loop Cable

The loop cable must be grounded when it passes between buildings, either in buried conduit or supported on an overhead "messenger wire."

( ) The loop cable must be grounded at each building entrance. To ground the loop cable, refer to Figure 3-7 for instructions.

( ) The "messenger wire," if used, must be grounded.

( ) The portion of the cable that attaches to the earth grounding wire should be placed in a junction box or inside the building to protect it from the elements.

Note: Lightning protection devices are not needed unless required by local codes.

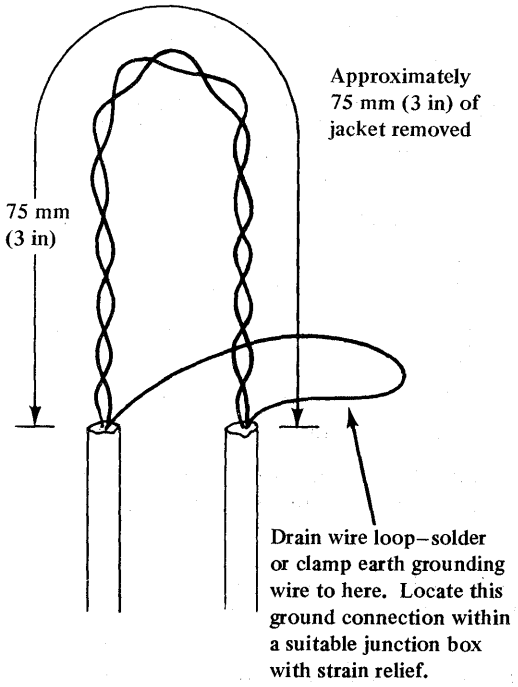


Figure 3-7. Grounding of loop cables between buildings

Loop Cable Length Requirements

The length of the loop cable must be considered when locating the entry stations.

The following information is provided to assist you in understanding the loop cable length requirements:

( ) Maximum length between operating entry stations is 610 m (2000 ft).

( ) Maximum length between the Series/1 and the first entry station or the Series/1 and the last entry station is 610 m (2000 ft).

( ) Recommended length is 305 m (1000 ft) between operating entry stations. This allows for bypassing an entry station requiring servicing, and still mainaining the 610-m (2000-ft) maximum cable length between entry stations.

( ) Maximum combined length of each loop is 1525 m (5000 ft).

( ) When determining cable lengths, allow for sufficient ceiling drop.

☐ When you understand the loop-length requirements, proceed to loop-cable routing to establish your cable lengths.

Loop Cable Routing

To calculate the length of loop cable required for your installation, the routing of each loop should be laid out on your floor plan. When planning the loop-cable routing, consider the following:

( ) Loop cables between buildings may be buried underground in conduit (plastic or metal) or run overhead on a suitable "messenger wire" for strain relief.

( ) To obtain maximum life expectancy from the cable, it should be buried in a conduit when it is installed outdoors.

Note: Over an extended period, a cable installed outdoors may fade or discolor.

( ) Allow sufficient cable for ceiling to floor drops, vertical and horizontal offsets, routings around obstructions, and electrical noise sources.

( ) No more than one loop cable splice should be used in any cable segment (distance between stations and Series/1 to the first and last station).

( ) Calculate the amount of loop cable required.

( ) Determine the quantity of 152-m (500-ft) and/or 305-m (1000-ft) spools required. Round off to the nearest 152-m (500-ft) spool.

☐ Indicate the length of loop cable required for each section of the loop on your floor plan.

Series/1 Data Collection Interactive Accessories

Figure 3-8 shows the IBM Series/1 Data Collection Interactive accessories.

The accessories you order should include:

( ) Station connectors (one per station plus a spare). Insulated crimp-type push on terminals and splice connectors are included for 20-AWG loop wire.

( ) Station-connector receptacle box, cover, and strain relief (one each per station connector) outside USA and Canada only

( ) Station mounting bracket (one per station)

( ) Loop wire, required for connecting all entry stations to the Series/1. This wire is twisted pair, 20 AWG, shielded, with drain wire for terminating shield.
- 152-m (500-ft) spools
- 305-m (1000-ft) spools

( ) Contacts closure connectors (one for each station having this option). Insulated crimp-type push-on terminals and splice connectors are included for 18–22-AWG wire.

☐ Order IBM accessories or equivalents 10 weeks before your installation.

Accessories With Bill of Material Number

- Entry station mounting bracket—2461781
- Crimp contact—2637682
- Crimp-on splice connector—0523176
- Loop connector—2731844
- Station connector assembly—2461780 (Note 1)
  When you order the station connector assembly, you receive:

  Station connector

  Push-on terminals

  Station address and loop label

  Crimp-on splice connector

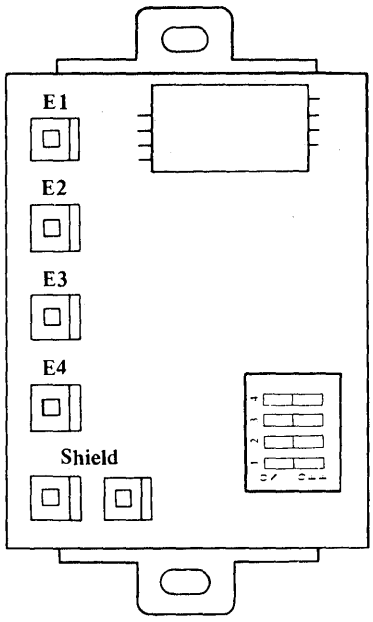
  Screws
- Contacts closure connector assembly—4413082 (Note 2)
  When you order the contacts closure connector assembly, you receive:

  Contacts closure connector
  Push-on terminals
  Crimp-on splice connector
  Screws
- Loop cable, 152-m (500-ft) spools—2461783
- Loop cable, 305-m (1000-ft) spools—2461784
- Station connector housing assembly—2461782 (for non-USA and Canada installation only)
  When you order the station connector housing assembly, you receive:

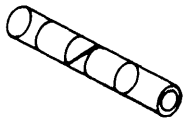
  Receptacle box
  Cover
  Strain relief
  Screws

Notes.

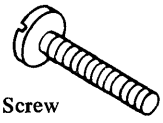
1. You should always keep a spare station connector assembly on hand. This spare should be ordered with the initial Series/1 Data Collection Interactive system order and replenished if used.
2. The contacts closure connector assembly is required for each entry station with the contacts closure option.



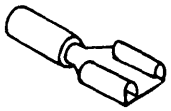
Station connector (Note 1)



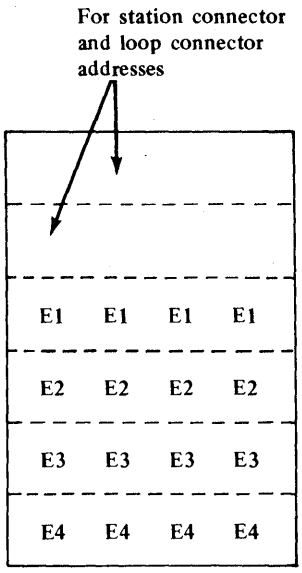
Crimp-on splice connector
(Notes 1 and 2)
(four per connector)



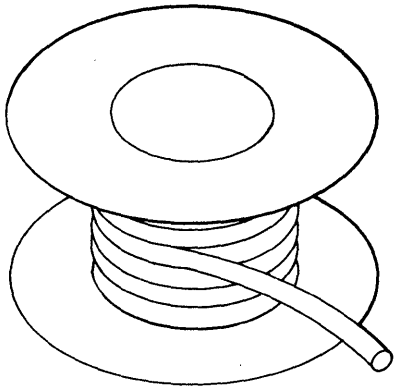
Screw
(Notes 1 and 2)
(Two per connector)



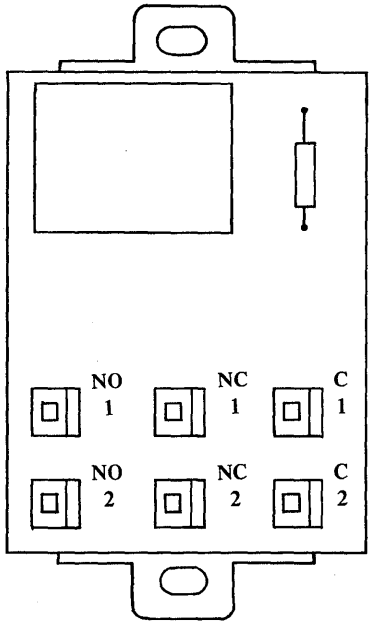
Push-on terminal
(Notes 1 and 2)
(Seven per connector)



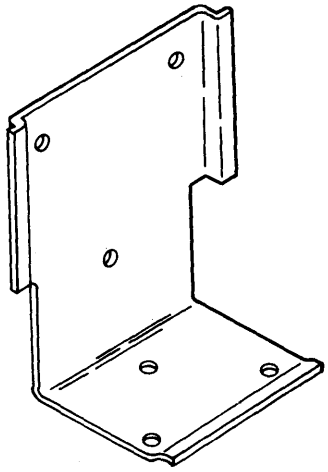
Address label (Note 1)



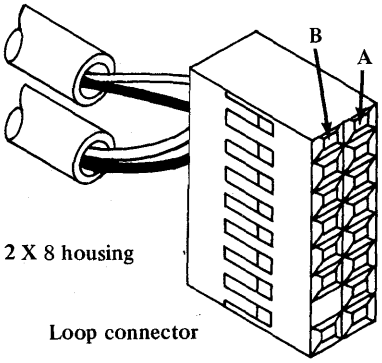
Loop cable



Contacts closure connector
(Note 2)

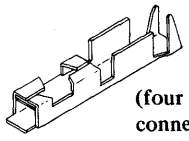


Mounting bracket



2 X 8 housing

Loop connector



(four per loop connector)

Crimp contact

Notes:

1. Supplied as part of station connector accessory.
2. Supplied as part of contacts closure connector accessory.

Figure 3-8. IBM accessories

Customer-Supplied Items

Figure 3-9 shows those items that you must supply.

- Power

( ) 115 Vac (for each entry station), terminated with a three-prong, 15-ampere *locking* receptacle (NEMA L5–15R).

( ) 115 Vac (for Central Facilities Maintenance of entry stations in the Series/1 area), terminated with a three-prong, 15-ampere, *locking* receptacle (NEMA L5–15R).

( ) 115 Vac, 15 amperes (for Central Facilities Maintenance of the value read module in the Series/1 area), terminated with a three-prong, 15-ampere, *locking* receptacle (NEMA L5–15R).

( ) 115 Vac, 15 amperes (for the use of test equipment for Central Facilities Maintenance in the Series/1 area), terminated with a standard three-prong, *non-locking* receptacle (NEMA 5–15R).

Notes:

1. Each of the preceding power outlets must have a non-current-carrying, third-wire grounding conductor; conduit ground is not acceptable.
2. Alternate voltages may be required in countries outside the USA and Canada. Check the Series/1 voltage ordered.
3. The Series/1 Data Collection Interactive must have a single power source for line frequency. You must not use one power-generating source for the Series/1 and a second power-generating source for the entry stations; however, you can use different voltage sources, such as different transformers and different circuits.
4. For power requirements for your Series/1, refer to the *IBM Series/1 Installation Manual—Physical Planning*, GA34-0029.

- Receptacles

( ) A station connector receptacle box with strain relief and single-hole cover for a station connector at each entry station location. This receptacle box should be of the type desired for each particular entry station location (handy box, wall mount, flush mount, exterior, etc.). This receptacle box must have a minimum opening width of 48 mm (1.9 in) and a minimum depth of 44 mm (1.75 in). (See Note 1.)

( ) If the contacts closure feature is installed, a receptacle box with strain relief and single-hole cover at each entry station location having the feature. The receptacle box should be the same type used for the station connector (see Notes 1 and 2).

Notes:

1. In countries other than the USA and Canada, a receptacle box, cover, and strain relief suitable for housing either the station connector or contacts closure connector are available as an IBM Series/1 Data Collection Interactive assembly.
2. If the metal receptacle box is used for housing either the station connector or the contacts closure connector, it should be grounded.

- Hardware

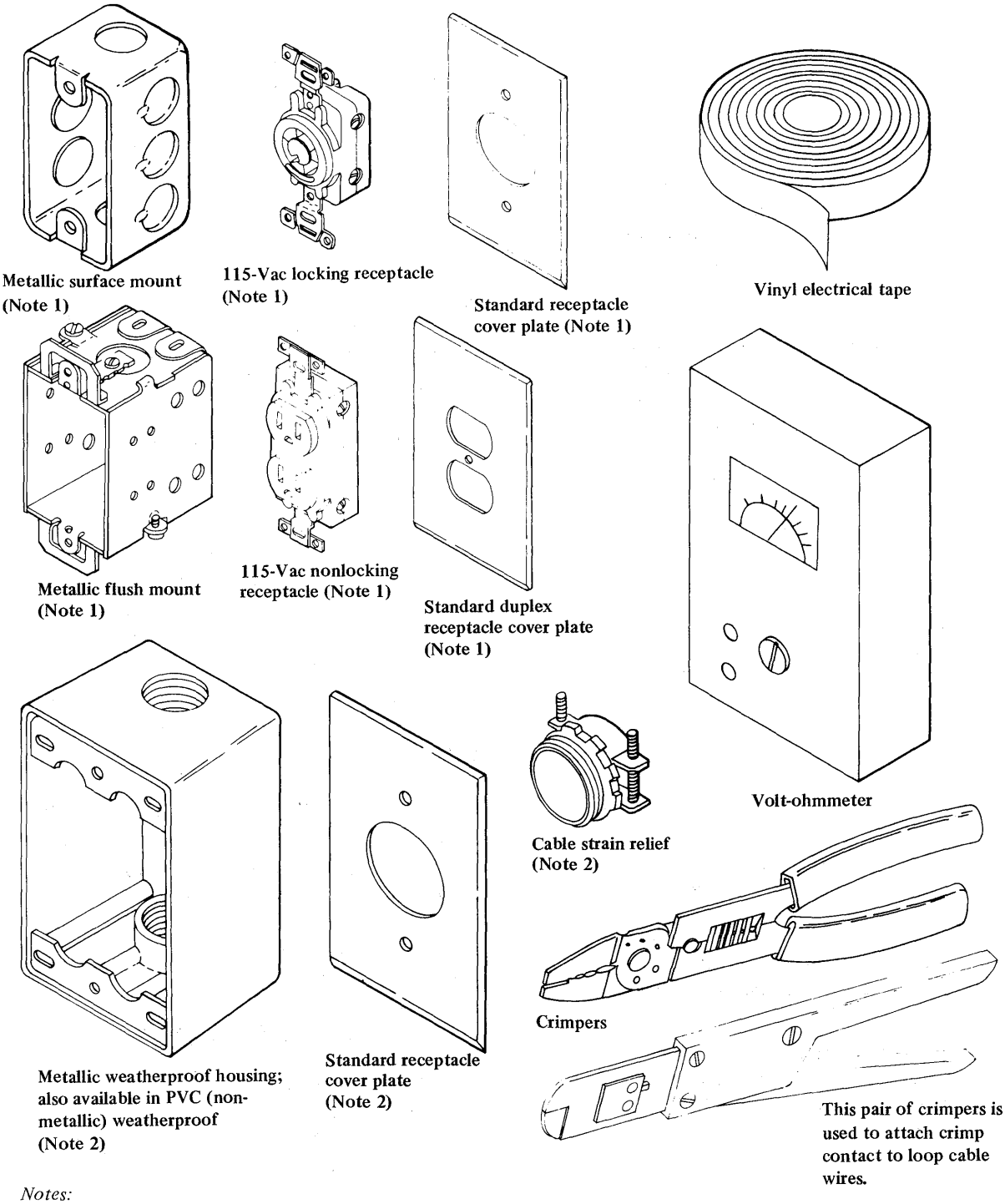
( ) Mounting hardware, such as screws, bolts, clamps, etc., to attach each station mounting bracket to the wall, beam, or pedestal, as specified by the person providing your floor plan layout

( ) Miscellaneous equipment, depending on the particular customer requirement or local electrical codes, such as:

Conduit for power wiring and/or loop wiring

Strain reliefs for all splices, station connectors, and power receptacles

Hangers, straps, etc., for routing all power and loop wiring



Notes:

1. Typical items used in U.S.A. and Canada; select appropriate items for your installation. For other countries, use equivalent item as required by alternate voltage.
2. In countries outside U.S.A. and Canada, metallic housing, cover plate, and cable strain relief are available as an assembly.

Figure 3-9. Parts not supplied by IBM

System Installation

The Series/1 Data Collection Interactive requires that you install the loop cabling, ac power, station connectors, mounting brackets, and related devices for the contacts closure feature, if that option is installed. To plan for the overall installation, indicate:

- The location of the IBM Series/1
- The location of each entry station
- The routing of all loop wiring between each station and the Series/1
- The routing of wiring and installation of external devices for the contacts closure feature, if installed

Note: If the value read feature is to be installed, refer to "Value Read Planning" in this chapter.

AC Power

AC power is to be installed at all entry stations, at the Series/1, and in the Central Facilities Maintenance area near the Series/1 (see Figure 3-2). Keep the following in mind:

( ) Each entry station has a 1.8-m (6-ft) power cord. Each station power receptacle should be located within 1.5 m (5 ft) of each station mounting bracket location and the Central Facilities Maintenance service bench.

( ) The Series/1 has a 4.3-m (14-ft) power cord. The power receptacle should be located within 3.6 m (12 ft) of the Series/1.

Note: Local codes may restrict a maximum power-cord length.

( ) All power outlets must have a third-wire grounding conductor and must be the locking type (NEMA L5-15R).

( ) Avoid use of power circuits where obvious sources of noise exist, such as portable drills, welders, etc., or where the circuit may be inadvertently turned off.

☐ Install the ac power required.

Loop Cable

When installing the loop cable (refer to Figure 3-10):

( ) Color coding and polarity *must be maintained* throughout the loop as well as from station connector to station connector. *IBM loop cable has a blue wire and a white wire.*

( ) The even-numbered tab terminals, E2 and E4, on each station connector are always connected to the white wire (see Figure 3-11).

( ) The odd-numbered tab terminals, E1 and E3, on each station connector are always connected to the blue wire (see Figure 3-11).

( ) The loop segment going from the loop multiplexer to station 1 should be identified, at the loop multiplexer end, as E3 and E4.

Note: Refer to Figure 3-10; note that the blue E3 wire at the loop connector connects to station 1 terminal E1, and the white E4 wire at the loop connector connects to station 1 terminal E2. This method of wiring should be used for the entire loop.

( ) Tab terminals E1, E2, E3, E4, and shield are push-on-type tab terminals used to connect the loop cable to the station connector. The terminal numbers are shown on the circuit board of the station connector (see Figure 3-11).

( ) Splices between entry stations are to be made with cable strain reliefs on each side of the splice. Splice crimp connectors are supplied by IBM with each station connector. Figures 3-12 and 3-13 show the two ways a splice can be made and the cable strain relieved.

( ) A splice is made with the IBM-provided crimp connectors or their equivalent. Whenever a splice is made, the shield drain wire must also be joined, using the splice crimp connectors, after which the shield drain wire must be carefully taped.

( ) Use care to ensure a reliable electrical splice.

( ) See "Loop Cable Routing" earlier in this chapter when running loop cable near or tied to power conduits.

☐ Install the loop cables.

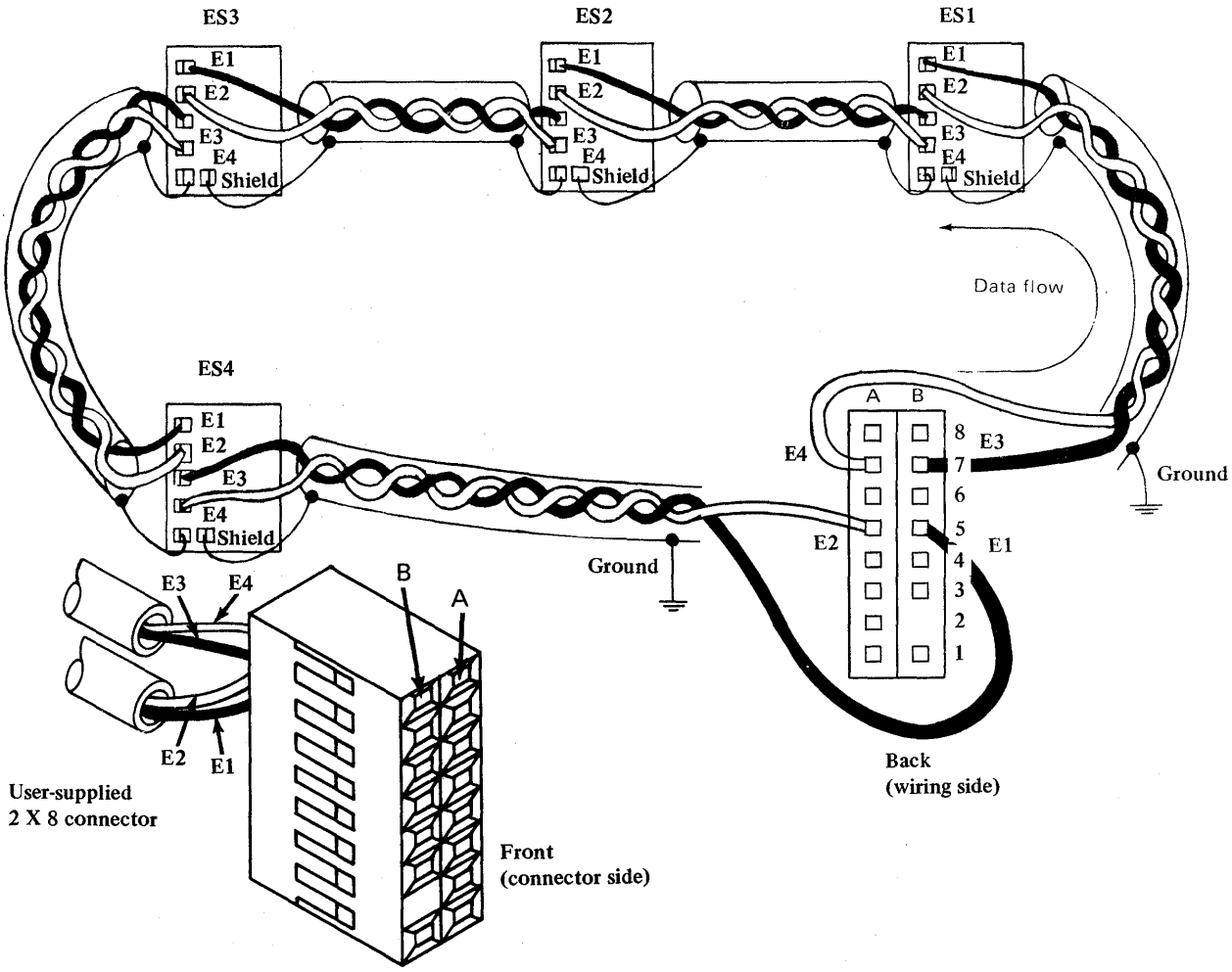


Figure 3-10. Loop cable wiring

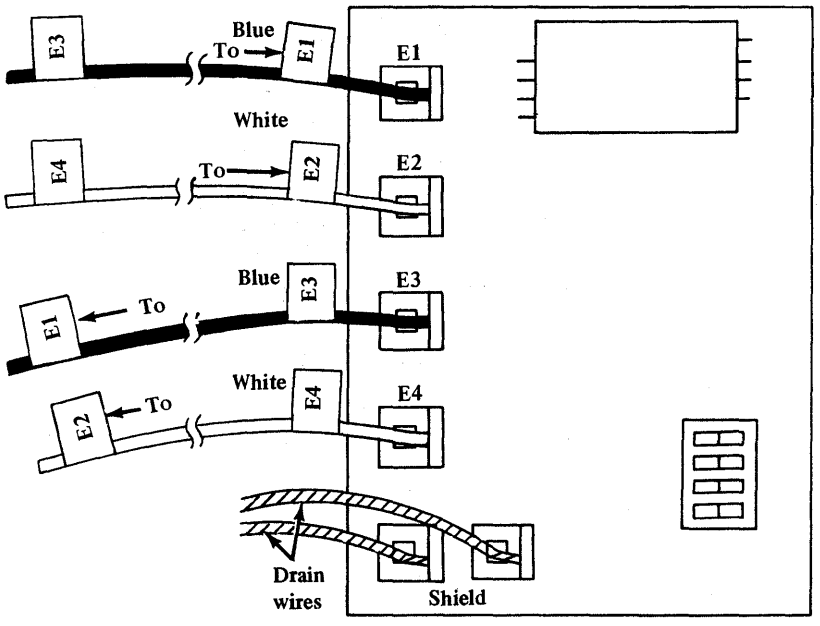


Figure 3-11. Color coding to tab pins

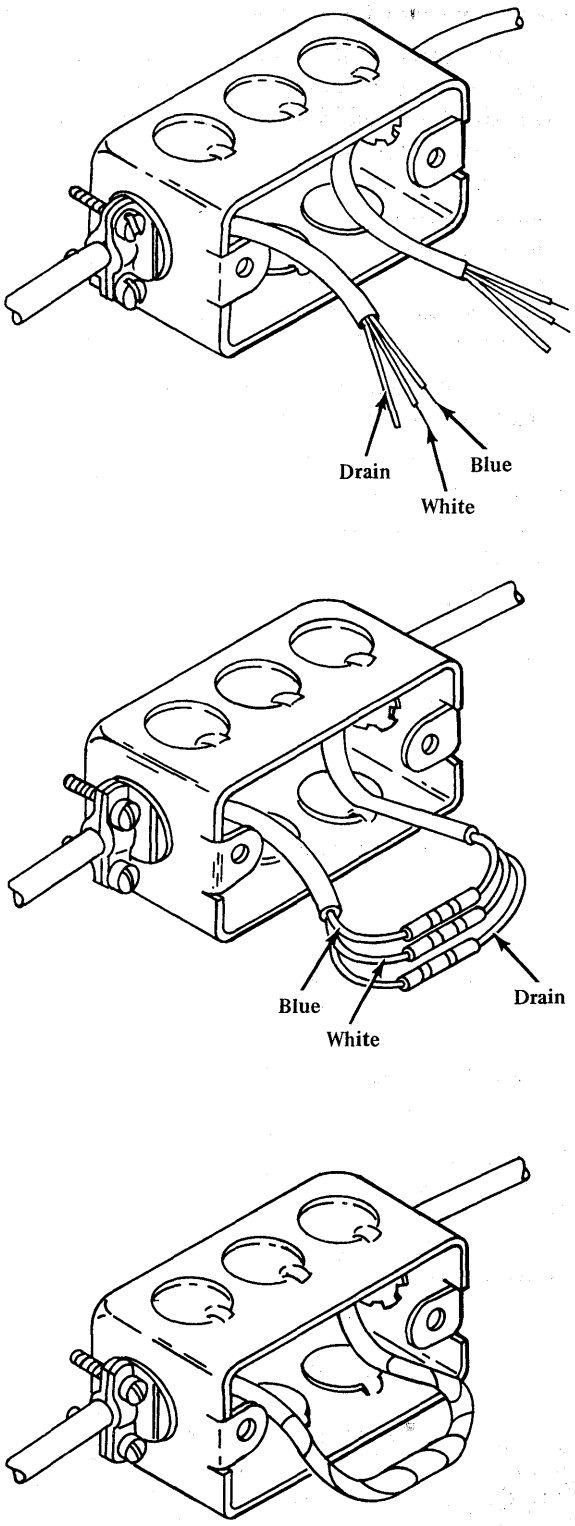


Figure 3-12. Junction box splice

One method of strain relieving a loop cable splice without using a junction box.

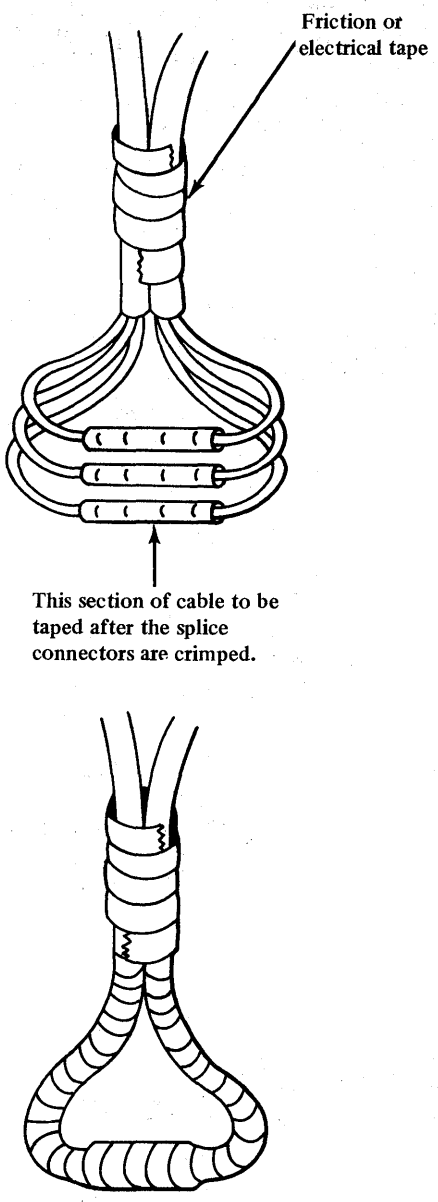


Figure 3-13. Cable splice

Mounting Brackets

( ) The entry station is designed to be wall mounted; however, it can be put on a floor pedestal or table (see Figure 3-14).

( ) The mounting bracket should be positioned so that the bottom of the bracket is 1143 mm (45 in) above the floor. This is only a recommended height, and it should be altered to suit the needs of employees using the entry station.

( ) The bracket is designed so that entry stations can be mounted and removed easily.

☐ Install mounting brackets.

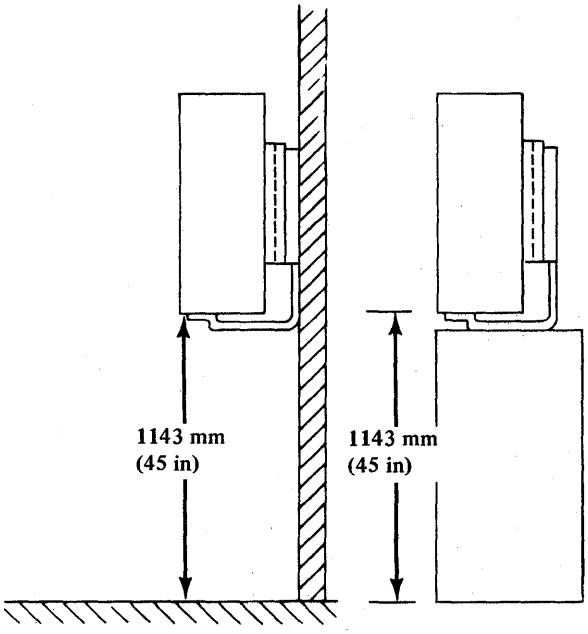


Figure 3-14. Mounting bracket height

Station Connector Housing and Cover

( ) A standard electrical box and cover are required at each entry station location (see Figures 3-15 and 3-16) to house the station connector. This box should be of the type suited for each entry station location (flush mount, surface mount, exterior, etc.). This box is the type used for a 115-Vac receptacle or wall switch. The cover should be a single-hole type, as used for a (NEMA L5–15R) 115-Vac power receptacle.

( ) This box should have a minimum opening width of 48 mm (1.9 in) and a minimum depth of 44 mm (1.75 in).

( ) Each entry station is supplied with a 1.2-m (4-ft) external cable, which plugs into the station connector.

( ) Location of the station connector receptacle box must be within 0.9 m (3 ft) of each entry station mounting bracket.

☐ Install station connector housings.

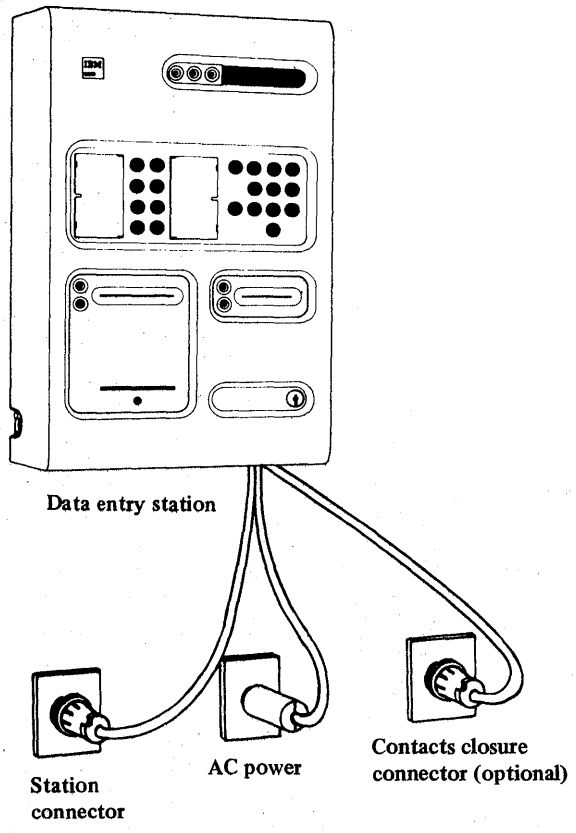


Figure 3-15. Entry station location

Contacts Closure Housing and Cover (Optional Feature)

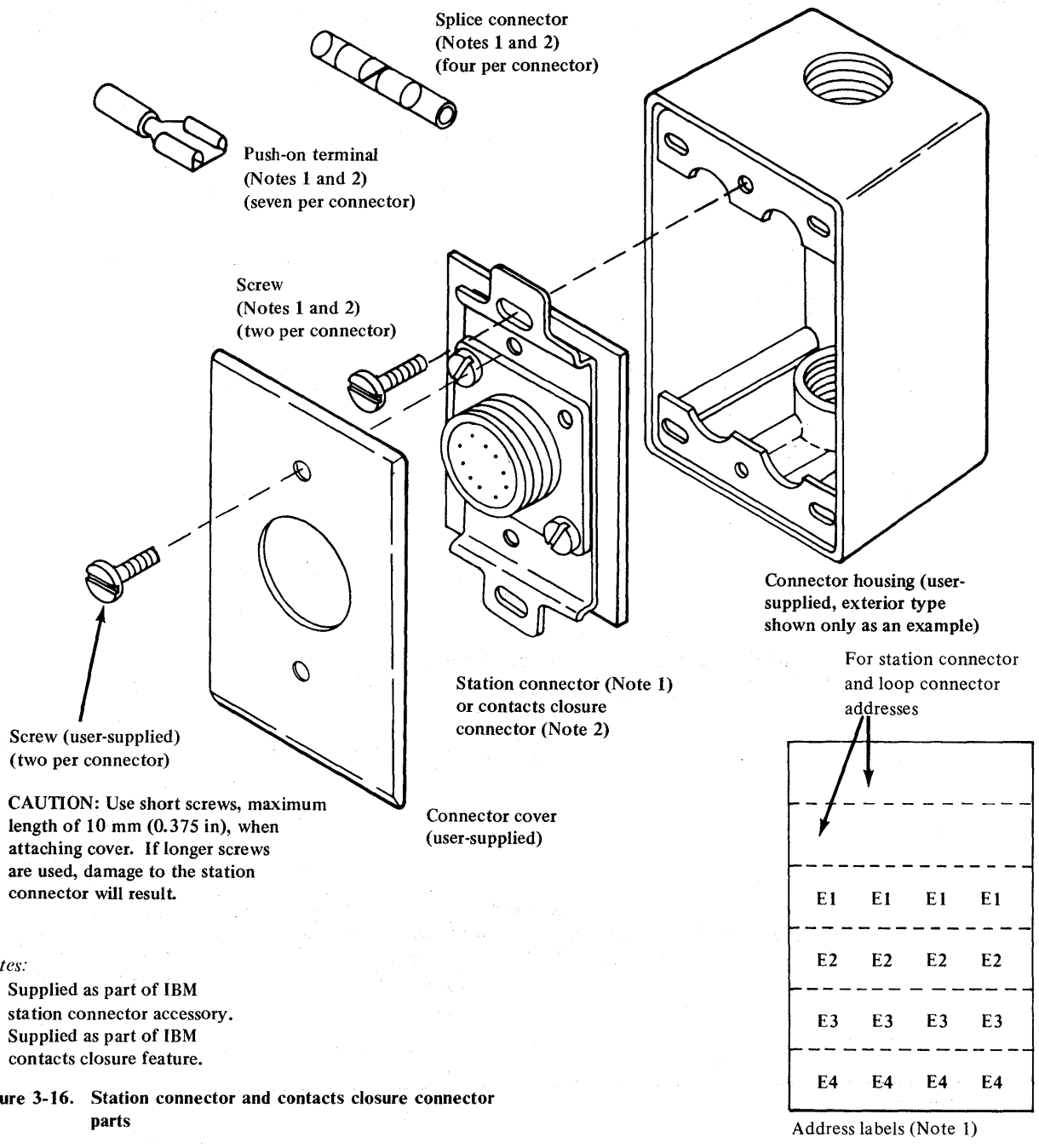
( ) A standard electrical box and cover are required at each entry station location having the contacts closure feature. This box should be the type suited for each entry station location (flush mount, surface mount, exterior, etc.). This box is the type used for a 115-Vac receptacle or wall switch. The cover should be a single-hole type, as used for a (NEMA L5–15R) 115-Vac power receptacle.

( ) This box should have a minimum opening width of 48 mm (1.9 in) and a minimum depth of 44 mm (1.75 in).

( ) Each entry station is supplied with a 1.8-m (6-ft) external cable, which plugs into the contacts closure connector.

( ) Location of the contacts closure connector receptacle box must be within 1.5 m (5 ft) of each entry station mounting bracket.

☐ Install contacts closure connector housings.



Notes:

1. Supplied as part of IBM station connector accessory.
2. Supplied as part of IBM contacts closure feature.

Figure 3-16. Station connector and contacts closure connector parts

Station Connectors

( ) Remove the station connector parts from the shipping package.

Perform the next series of steps, using a volt-ohmmeter, vinyl electrical tape, and a pair of crimpers.

( ) At the multiplexer end of the loop, select the cable going from the multiplexer to station 1, and prepare it as shown in Figure 3-17.

( ) Label the blue wire E3, as shown in Figure 3-18.

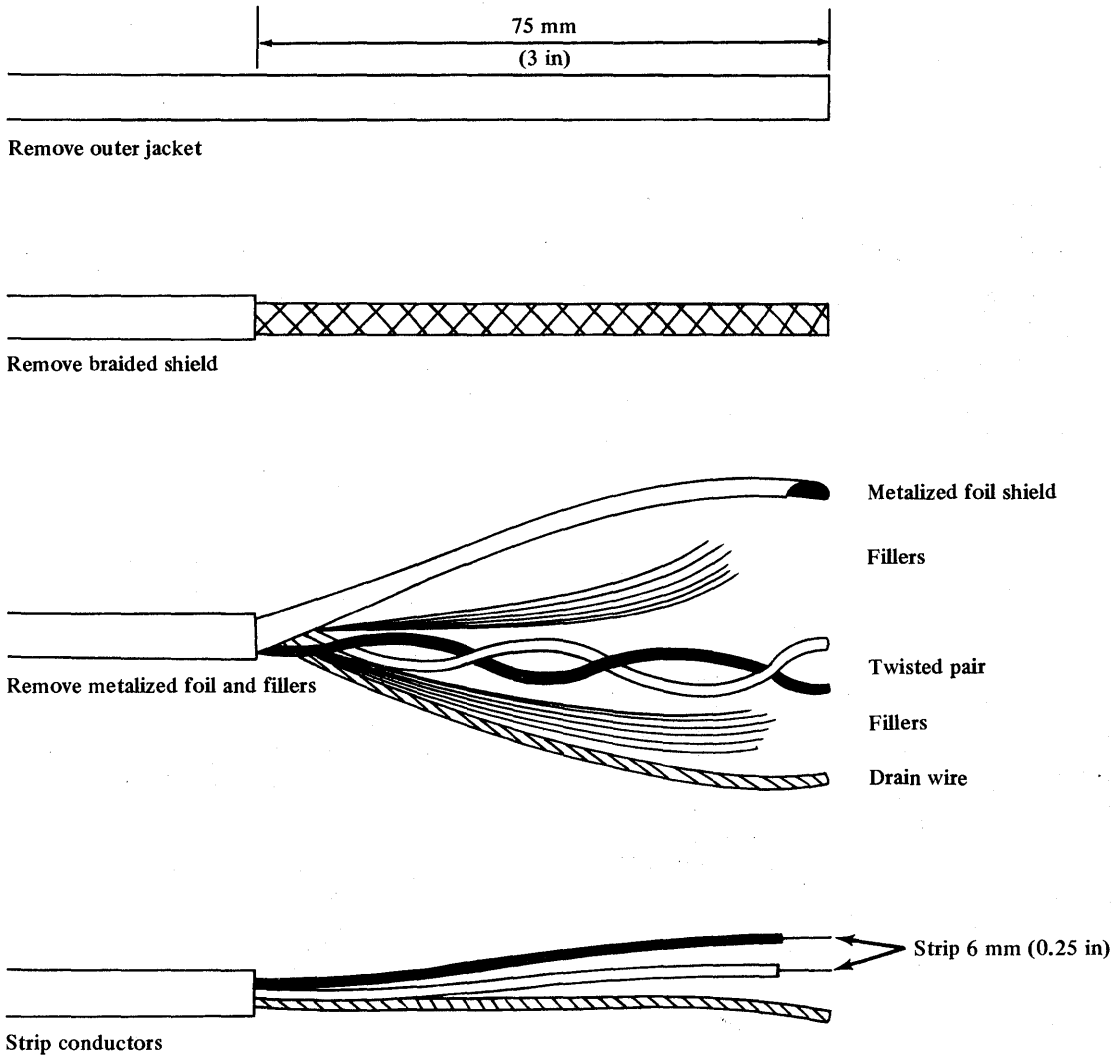
( ) Label the white wire E4, as shown in Figure 3-18.

( ) Set the volt-ohmmeter to read resistance.

( ) Connect the meter leads to wires E3 and E4; there should be no continuity.

( ) Twist the stripped wires together so that they are shorted.

( ) At station 1, prepare the cable as shown in Figure 3-17.



Note: This drawing can be used as a template

Figure 3-17. Cable preparation

( ) Select one of the cables and connect one meter lead to each wire of a blue-white pair (see Figure 3-18). Label the blue-white pair that shows continuity; the blue wire is E1 and the white wire is E2.

Note: There should be continuity between only one blue-white pair of wires.

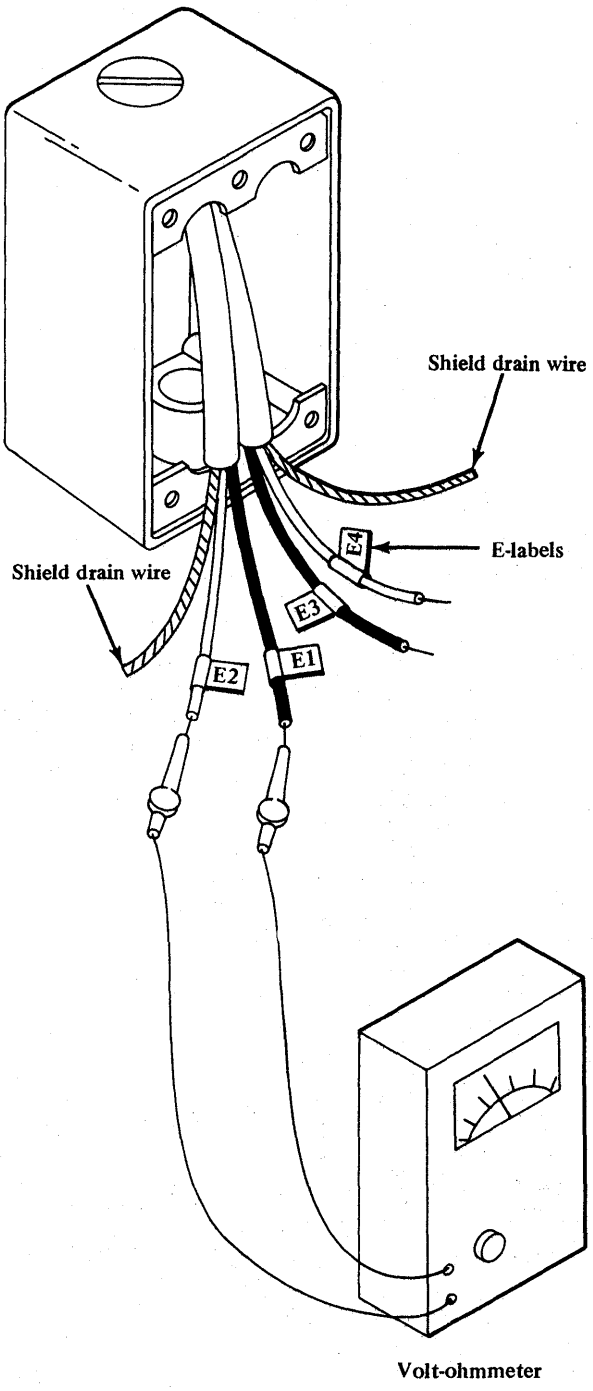


Figure 3-18. Cable preparation, station connector

( ) This blue-white pair, E1 and E2, should have a dc resistance reading of less than 52 ohms. A reading in excess of 52 ohms is an indication of an open or a high-resistance circuit, and the problem must be corrected before continuing.

( ) Connect the meter leads to the other blue-white pair of wires; there should be no continuity.

( ) Label this pair (no continuity); the blue wire is E3 and the white wire is E4.

( ) Crimp a push-on terminal to each wire.

( ) Crimp a push-on terminal to each shield drain wire and tape the exposed shield drain wire.

( ) Short wires E3 and E4 together, as shown in Figure 3-19.

( ) Label the receptacle station 1.

☐ Repeat procedure for all stations in each loop; then label the return ends to the multiplexer as E1 and E2, as shown in Figure 3-18.

Note: Do not crimp terminals to the multiplexer ends of the loop.

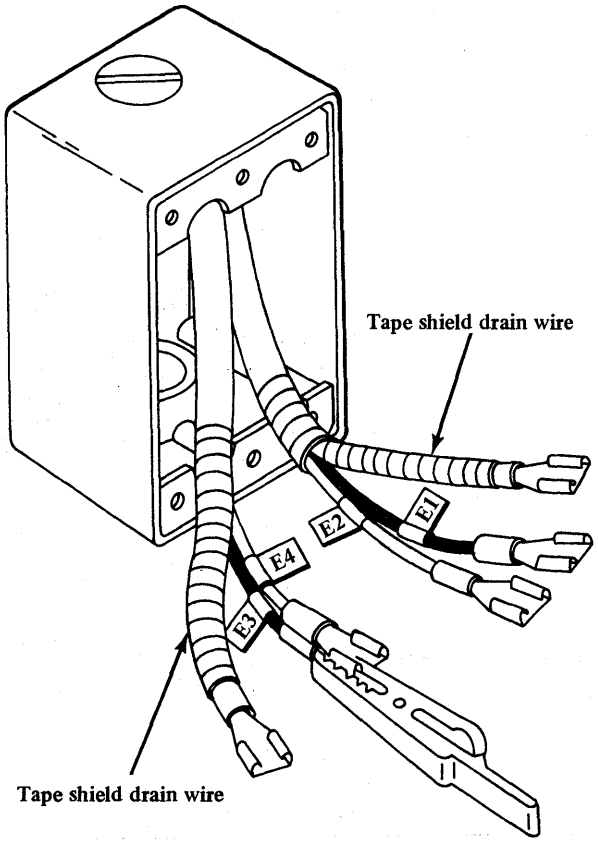


Figure 3-19. Shorted wires E3 and E4

Station Connector Addresses

Each station connector *must* have its own unique address assigned, as indicated on your floor plan, to permit sorting of output records by entry station. For the Central Facilities Maintenance loop port, the rocker switch must be set to 0. To address the station connectors:

( ) Position the station connector, as shown in Figure 3-20, with the rocker switch on the bottom and the terminal tabs to the left.

( ) Figure 3-21 shows how each station of every loop is addressed by setting the rocker switch.

( ) When you have completed addressing the station connector assembly, mark the station address on one of the blank labels provided with the station connector and place it on the front of the cover plate you provided; replace the station connector and cover plate in the box.

☐ Address all the station connectors, as indicated by your floor plan.

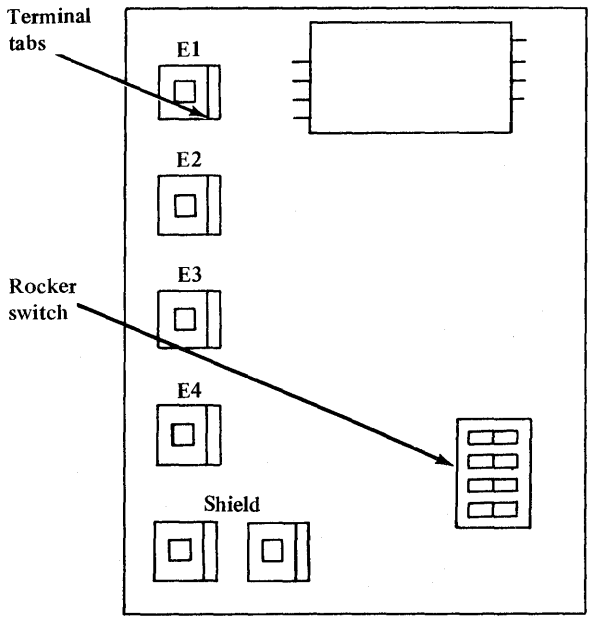


Figure 3-20. Station connector orientation

Now that the station connectors are addressed, install them (using your floor plan) at the appropriate station connector housing as follows:

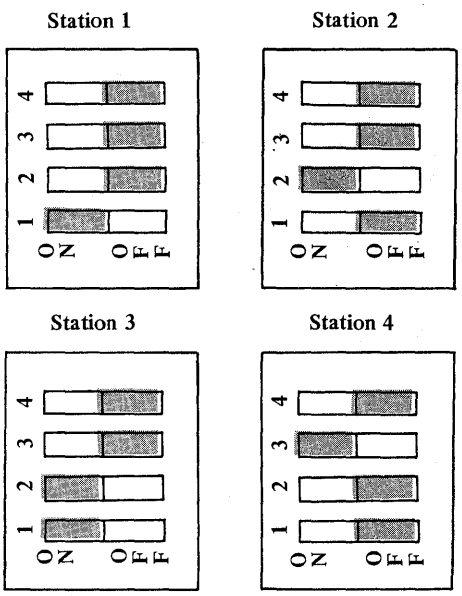
( ) Remove the appropriate station connector assembly from the box.

( ) Connect the corresponding labeled wires to the labeled terminal tabs on the station connector assembly.

( ) Be sure that the cable shield drain wire is terminated at the shield tab and is insulated from touching any metal inside the station connector housing.

( ) Fold the wires into the housing and attach the station connector cover with the two screws provided.

☐ Repeat this procedure for each station connector.



Note: Darkened portion indicates end of rocker to be pushed down. Switch 4 must always be in OFF position to allow output of data records.

Figure 3-21. Station addressing

Contacts Closure Connector

( ) Remove the contacts closure connector from the box.

( ) Strip the wires that terminate at the contacts closure connector to expose 5 mm (0.20 in) of wire.

( ) Crimp a push-on terminal to each wire.

( ) Attach the leads to the appropriate terminal tab on the contacts closure connector.

( ) Fold the wires into the housing and attach the contacts closure connector to the station connector box, using the two screws provided.

( ) Attach the contacts closure connector cover, using two screws.

☐ Repeat this procedure for each contacts closure connector (see Figures 3-22 and 3-23).

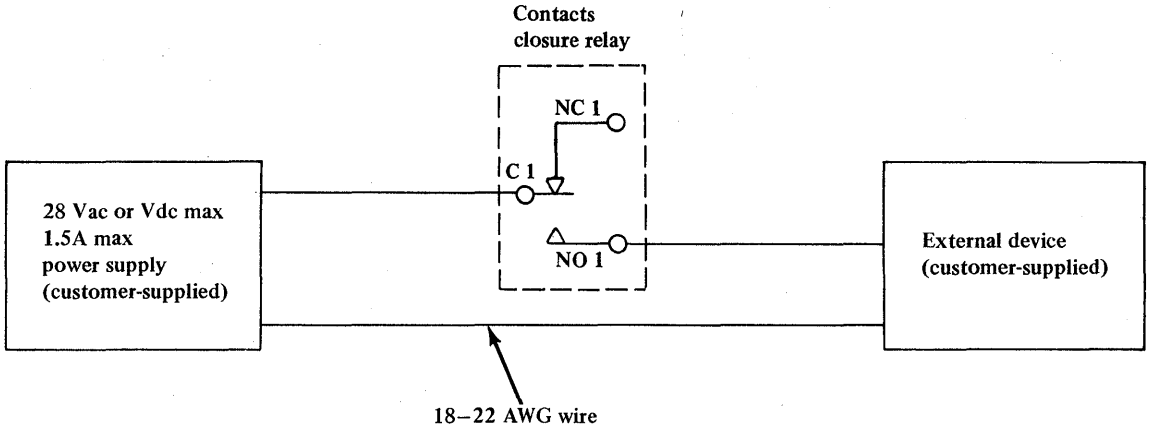
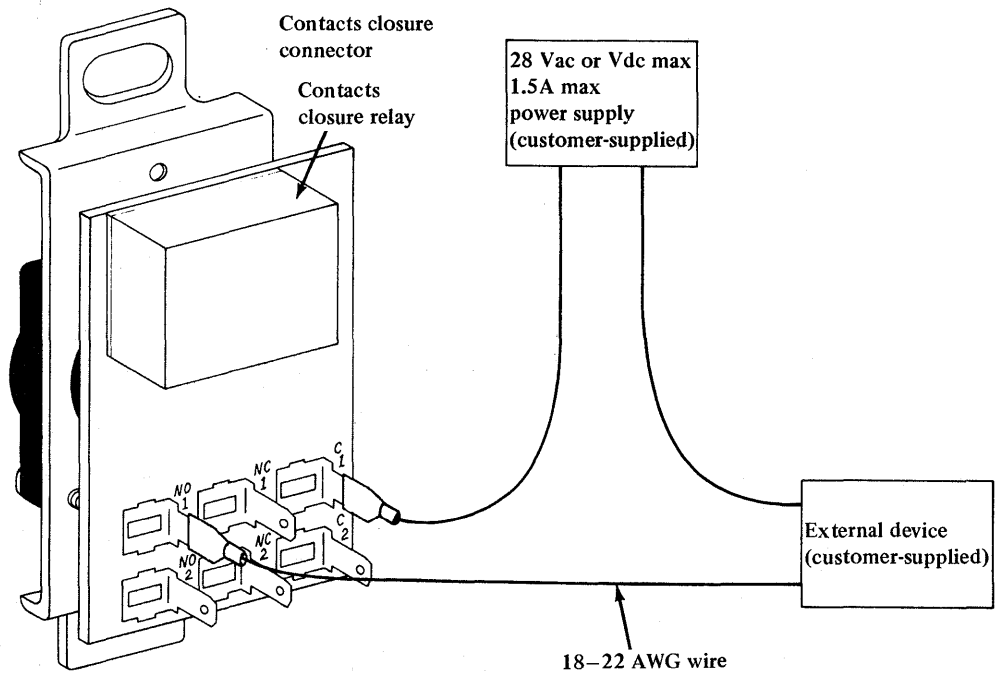


Figure 3-22. Circuit of contacts closure relay attached to external device



Note: Figures 3-22 and 3-23 are shown for reference only. The application of the feature will determine the circuit design.

Figure 3-23. Hookup of contacts closure relay attached to external device

Loop Connector

Figure 3-24 shows the loop connector. Use the following procedure to install each loop connector:

( ) Crimp a connector pin to each wire: E1, E2, E3, and E4.

( ) Push wires E1 and E2 into the loop connector from the rear. Ensure that the loop cable labels match the loop connector positions, as shown in Figure 3-24.

( ) Push wires E3 and E4 into the loop connector from the rear. Again, ensure that the loop cable labels match the loop connector positions, as shown in Figure 3-24.

( ) Install connector pins in empty connector positions to ensure tight connection.

( ) Remove 1 inch of outer cable jacket and clamp to Series/1 frame ground.

☐ Repeat this procedure for each loop.

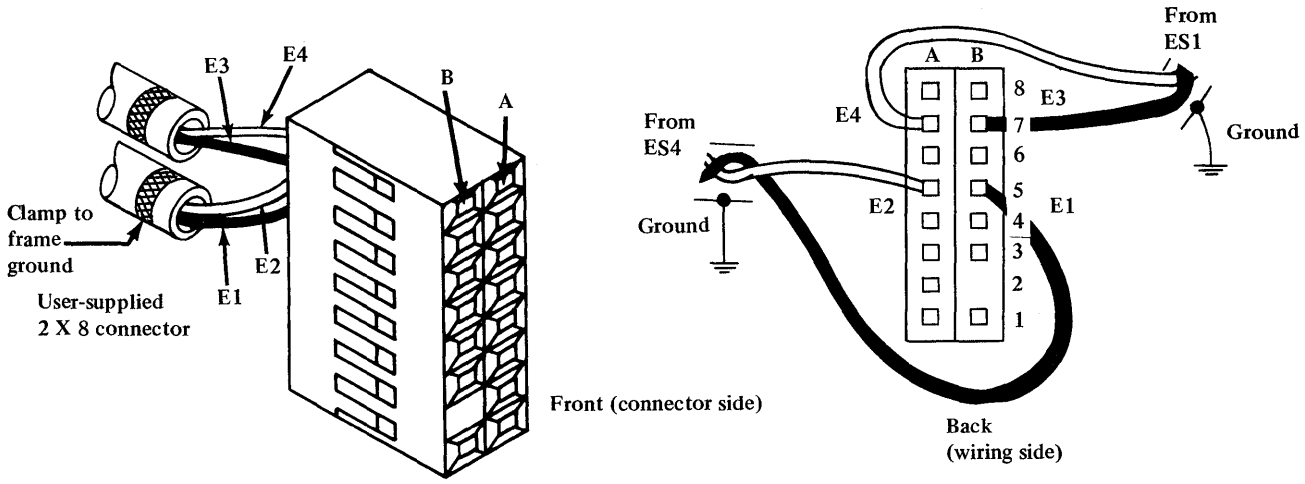


Figure 3-24. Loop connector positions

Ring Out and Test Total Loop

Note: If a problem is encountered at any point in the checkout, the problem must be corrected before continuing.

( ) At the Series/1 location, use the volt-ohmmeter to measure for resistance between E1 and E3, by placing one meter lead into socket E1 and the other meter lead into socket E3 (Figure 3-25).

( ) Repeat for sockets E2 and E4.

( ) Use the following table to determine the maximum resistance allowed:

Loop length	Maximum resistance (ohms)
1525 m (5000 ft)	65
1372 m (4500 ft)	59
1220 m (4000 ft)	52
1067 m (3500 ft)	45
915 m (3000 ft)	39
762 m (2500 ft)	33
610 m (2000 ft)	26
457 m (1500 ft)	20
305 m (1000 ft)	13

( ) Check for an open circuit (no continuity) between E1 and E2.

( ) Check for continuity between both shield drain wires.

( ) Check for no continuity between E1 and shield drain wire.

( ) Check for no continuity between E2 and shield drain wire.

( ) Check that the loop shield is not grounded.

( ) Do not attach loop connectors to the attachment cards.

( ) Repeat this procedure for each loop.

☐ "Ring out" and test total loop.

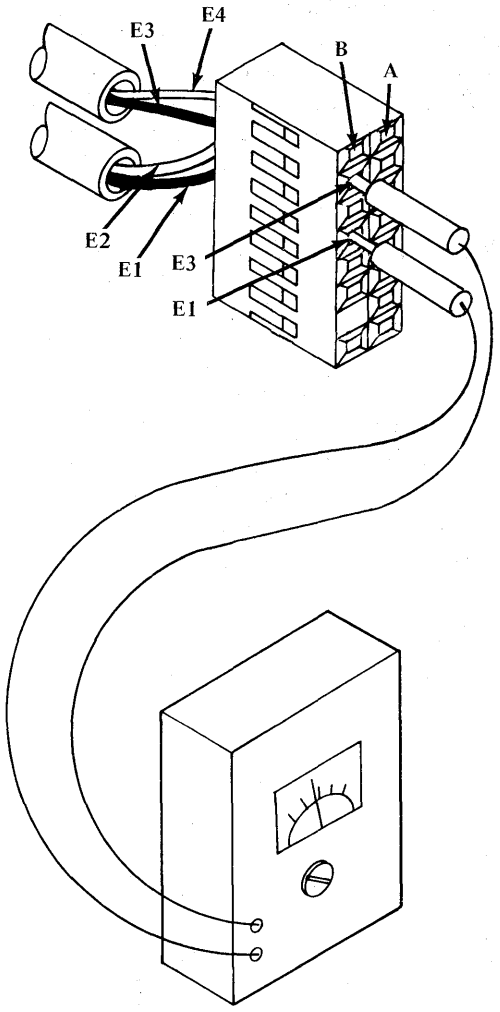


Figure 3-25. DC resistance check

Value Read Planning

The installation for value read requires planning to ensure a smooth and trouble-free installation. The planning for the overall installation and value read device wiring must be completed before the delivery of the 5239 Value Read Module.

To help you plan a successful value read installation, this section is presented in a logical step-by-step sequence. Read each step completely before finishing the operation, which is indicated by □. Steps leading to the specified operations have ( ) at the beginning of the step. Some of these steps are information instructions, while others require that you perform a specific action. When you understand or complete a step, check it off. Remember, you must check off all steps preceded by ( ) before completing an operation, as specified by □.

Value Read Planning Checklist

Areas that should be considered during your value read planning sessions include:

- Planning your floor plan layout for the value read module and external devices.
- Ensuring availability of proper power for the value read module.
- Planning the wiring of the value read module to the external device.
- Selecting the mode of operation.
- Determining hardware requirements (switches, terminals, connectors, etc.).
- Ensuring compatibility of external device to value read module.
- Consideration of electrical noise and atmospheric contaminants; refer to "System Planning" in this chapter for details.

Floor Plan of Value Read Installation

Use the physical specifications for the 5239 Value Read Module and Figure 3-26 to establish a floor plan. Consider the following:

( ) The module **1** must be located within 1.5 m (5 ft) of a power source **2**.

( ) The module **1** must be located within 1.5 m (5 ft) of the data entry station **3**.

□ Indicate on your system floor plan the location of all value read modules, external devices, and cabling between the value read modules and external devices.

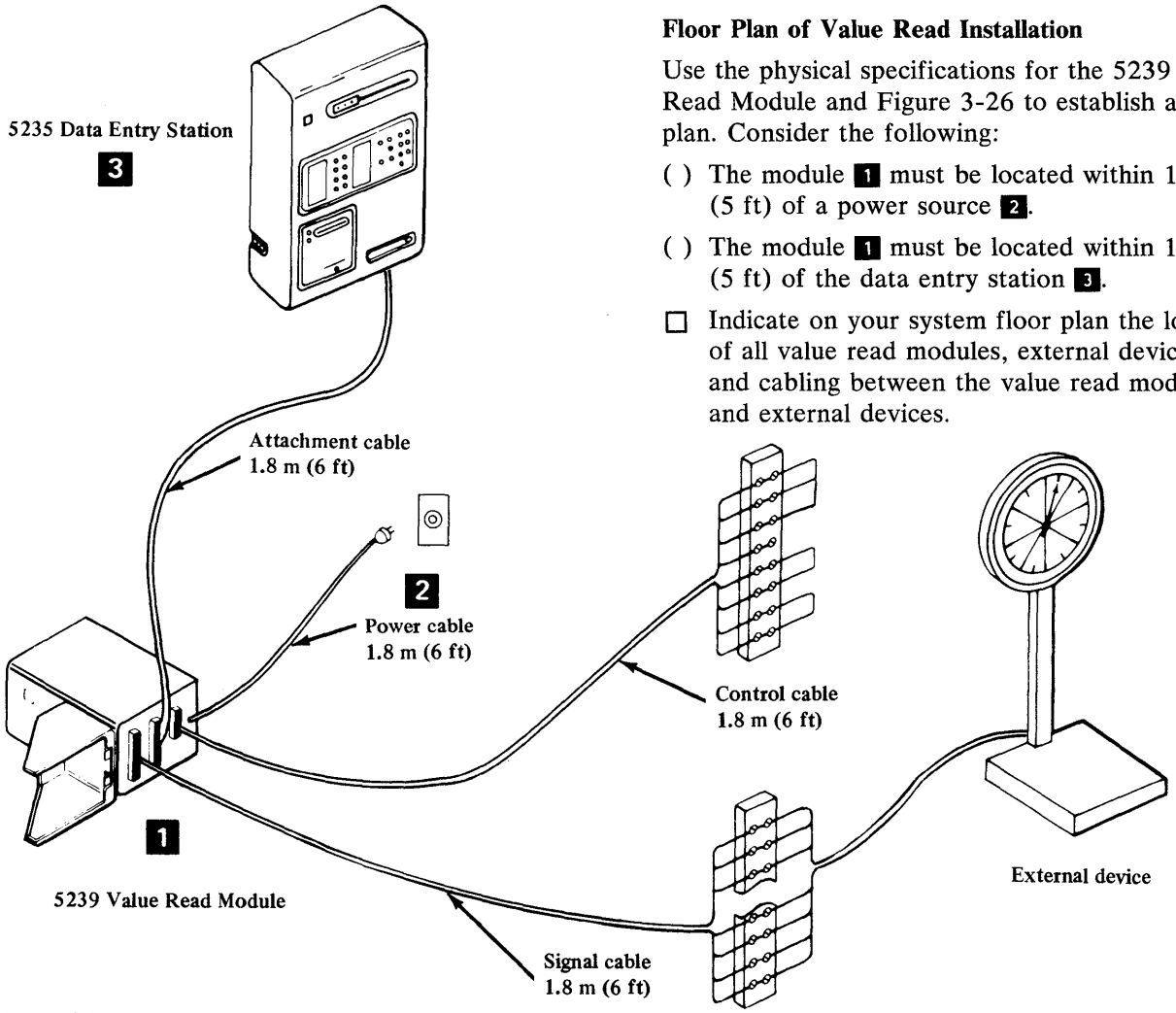


Figure 3-26. Value read installation

AC Power for the 5239 Value Read Module

( ) The ac power receptacle should be located within 1.5 m (5 ft) of the module mounting location.

( ) The ac power supplied for the module must have a third-wire grounding conductor. *This is a non-current carrying ground, not a neutral.*

( ) For voltage requirements, refer to "5239 Value Read Module Features and Specifications" in this chapter.

☐ Indicate on your system floor plan the location of the ac receptacle required for all 5239 modules.

Mode Selection

( ) Determine the mode or modes of operation required for your application. (Refer to "5239 Value Read Module" in Chapter 1 for a description of the modes.)

( ) Using the control cable option chart in Figure 3-27, determine the control cable wires that must be tied together to select the desired mode.

( ) Determine the method of mode selection at the end of the control cable. Methods may include:

- Jumpers on a terminal strip
- Twisting and soldering wires together
- Switches for selection of frequently used modes

( ) Determine if additional personalizing is necessary to permit operation with selected modes.

( ) Determine if external switch is required for switching between action key 7 and action key 8.

( ) Determine the external source signal if semiautomatic or automatic operation is to be used.

( ) Determine if the external source signal is supplied to the module through the control cable or through the signal cable. (Both input paths must not be used at the same time.)

☐ Indicate on your plan the modes required at each 5239 module and the wiring required to select the mode of operation.

Device-Dependent Options

( ) Determine if the external device supplies an odd parity bit per digit. The no-parity option must be selected if parity is not supplied by the external device.

( ) Determine if the external device supplies a 'data ready' signal. The continuous data ready option must be selected if the 'data ready' signal is not supplied by the external device.

( ) Refer to Figure 3-27 for the method of selecting the no-parity or continuous data ready option.

☐ Indicate on your plan which options are required, and which wires must be tied together at the end of the control cable to select the option.

Signal Cable Wiring

( ) Determine the wiring connections necessary to attach the external device(s) to the stubbed end of the signal cable. Refer to the signal cable wire list in Figure 3-28 and to Figure 3-32.

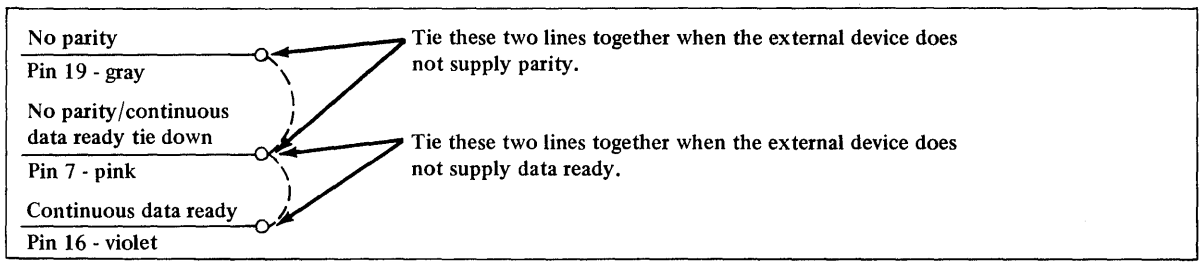
☐ Indicate on your plan the signal cable wire number and the external device wire number that must be connected to each other. Do this for all lines that connect the external device to the 5239 Value Read Module.

Selecting Device-Dependent Options and Modes

Selection of device-dependent options and modes is performed at the stubbed end of the control cable.

Figure 3-27 shows the lines in the control cable and the results of tying selected lines together. The mode selection options are shown with a chart for the recommended connections to select each of the four modes.

Device-dependent options:



Mode-selection options:

Connections required for mode selection	Manual	Protected	Semi-automatic	Automatic
Protected in, Pin 1 - black; Protected out, Pin 2 - brown. Tying these lines together locks out the key entry keyboard on the entry station for action 7, F1 (only).	Not required	Required	Required	Required
External source in, Pin 24 - white; External source out, Pin 12 - orange. Each time these two lines are switched together (40 ms minimum) and then released, action 7 or 8, depending on the action selected with the action select line, is initiated. *Note:* An equivalent external source line is available in the signal cable.	Not required	Not required	Required	Required
Auto enter in, Pin 3 - tan; Auto enter out, Pin 4 - red. Tying these lines together causes automatic entry of the value, once action 7 or 8 is initiated by the external source signal.	Not required	Not required	Not required	Required
Action key 7 active, Pin 15 - aqua; Action select, Pin 13 - yellow; Action key 8 active, Pin 14 - blue; Optional switch. Following the closure and opening of the external source switch device, either action 7 or 8 is initiated, depending on the position of the optional switch.	Not required	Not required	Either action key 7 active or action key 8 active must be selected, but both positions must not be selected at the same time.	

Figure 3-27. Control cable options

Signal Levels for 1-of-10 Operation

The external device must supply only a dry-contact closure with a minimum rating of 24 Vdc at 25 milliamperes for all signal lines except for the 'release in/out' lines. The 5239 supplies a dry-contact closure rated at 115 Vac at 0.5 amp, maximum, for the release 'in/out lines.'

The maximum circuit resistance measured between an 'address' line and a selected 'data' (digit) line at the signal cable input to the value read module must not exceed 220 ohms (refer to Figure 3-28).

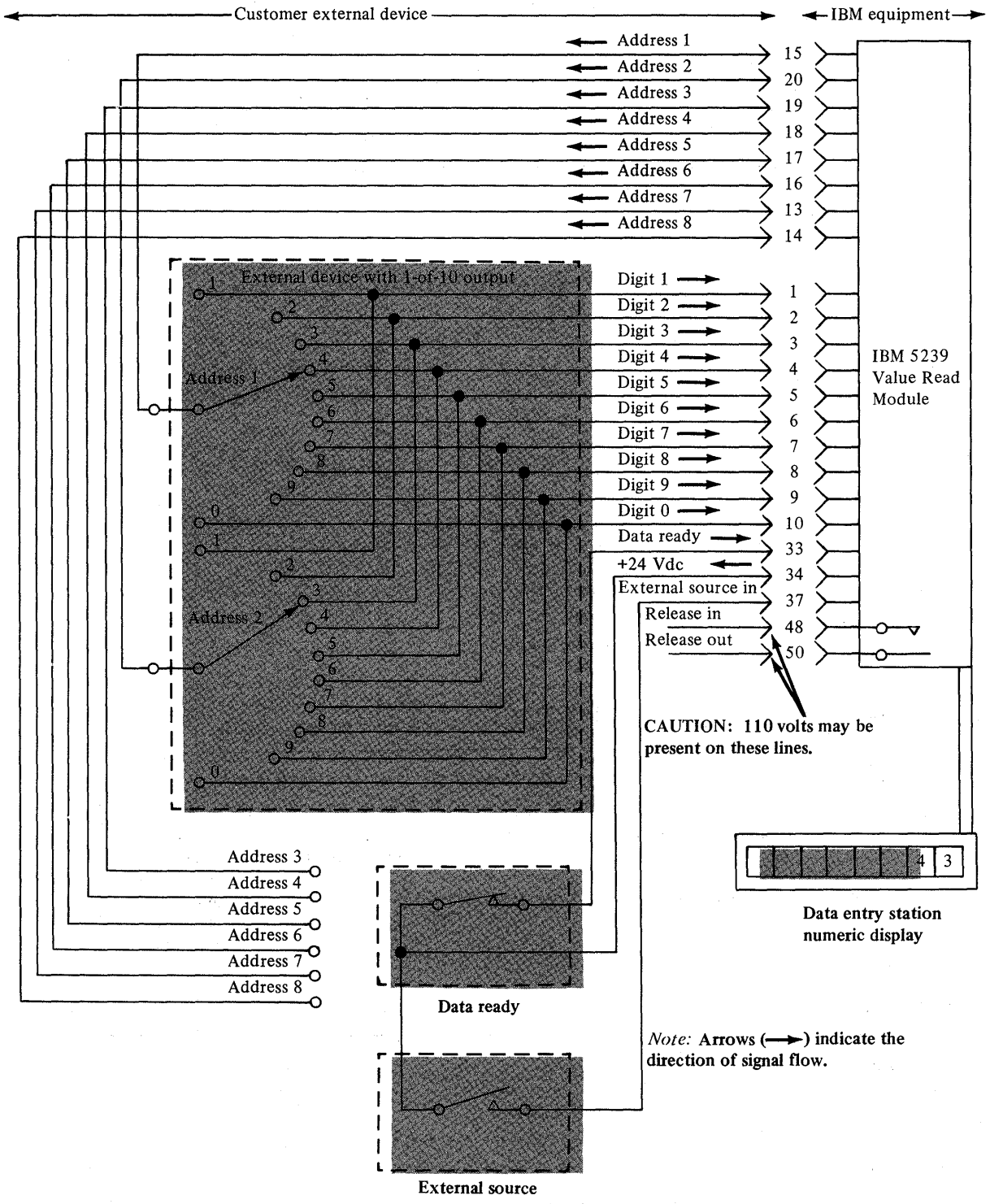


Figure 3-28. 1-of-10 device attached to the 5239 Value Read Module

Hardware Requirements

( ) Determine the hardware (terminal strips, switches, plugs, screws, etc.) necessary to complete the installation.

☐ Order the required hardware.

External-Device Supplier Information

( ) The external device attached to the 5239 module must be compatible with the timing and input circuitry of the module. To assist both you and the supplier of the external device to determine compatibility, the section "External-Device Supplier Value Read Information," in this chapter, has been included for your use.

☐ During your planning meeting with the supplier of the external devices, you should make available the information in the "External-Device Supplier Information" section.

Installation Instructions for Value Read

To ensure a smooth and trouble-free installation, all the items covered under "Value Read Planning" in this chapter should be understood and completed before delivery of the 5239 Value Read Module. Before beginning the step-by-step instructions for the installation of the value read module, you should understand what IBM supplies and what you must supply.

IBM-Supplied Items

- Supplied with the data entry station value read attachment feature.
  - A 1.8-m (6-ft) attachment cable with a 50-pin plug to mate with the 5239 attachment cable connector.
- Supplied with the value read module
  - A 1.8-m (6-ft) signal cable with a 50-pin plug (Amphenol or Cinch part number 57-30500 or equivalent) to mate with the 5239 signal cable connector. The external device end of the cable has stripped, pretinned, and labeled wires.
  - A 1.8-m (6-ft) control cable with a 24-pin plug (Amphenol or Cinch part number 57-30240 or equivalent) to mate with the 5239 control cable connector. The stubbed end of the cable has stripped, pretinned, color-coded wires with labels.
  - Three wrap plugs, which are diagnostic tools used by the customer for problem determination.
  - Mounting brackets to attach the module to the wall (if desired).

Customer-Supplied Items

- An external device that is compatible with the 5239 Value Read Module
- AC power for the 5239 Value Read Module
- A suitable location for the module
- Mounting hardware to secure mounting brackets (if wall-mounted)
- A table or pedestal for the module (if the wall mounting is not used)
- A terminal strip, plug, or similar device for attaching the signal cable to the cable from the external device and for selecting the control cable modes and options
- An additional cable for attaching one end of the signal cable to the external device. This is required only if the external device cable is not long enough to reach the 1.8-m (6-ft) signal cable.
- A junction box or enclosure for signal cable terminal strips
- Switches, plugs, connectors, and any other type of hardware required for mode and option selection

Cabling the Module

Figure 3-29 can assist you with the installation of the following cables to the 5239 Value Read Module:

CAUTION: Up to 110 Vac may be present on wires 48 and 50.

- Signal cable—plug the cable 50-pin connector, which comes from the external device, into location 1 on the module.
- Attachment cable—plug the 50-pin ribbon connector, which comes from the entry station, into location 2 on the module.
- Control cable—plug the 24-pin connector cable into location 3 on the module.

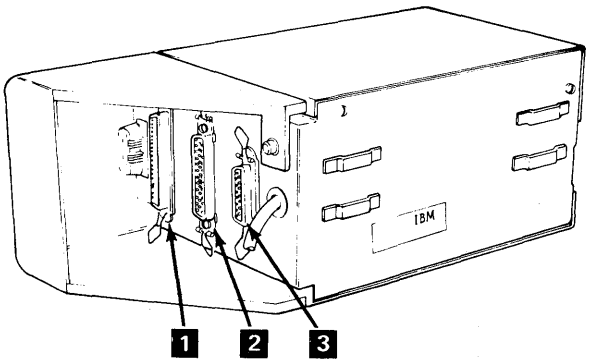


Figure 3-29. Value read cabling

Signal Cable Termination

CAUTION: Up to 110 Vac may be present on wires 48 and 50.

Using the plan established during the planning phase of the installation, connect the signal cable wires to the wires from the external device.

- If a terminal strip is to be used to attach the wires together, it should be no more than 1.5 m (5 ft) from the module.
- If a terminal strip is used to attach the signal cable to the external device, precautions should be taken to shield the release lines used on the 1-of-10 dry contact electromechanical devices.
- Using the established plan, attach the signal cable wires to the wires from the external device.

Mode and Option Selection

Using the plan established during the planning phase of the installation, select the required modes and device-dependent options:

- Tie the appropriate mode-selection wires together, as indicated on the plan.
- Tie any necessary option-selection wires together.
- If required, install the action key select switch and attach the appropriate wires to the switch.
- If required, install the external source (photocell, switch, etc.) and attach the wires from the external source to the input wires for the external source at the control cable.

Value Read Module Mounting Bracket Template

To wall-mount the value read module, use Figure 3-30 as a template and follow the procedures in steps 1 through 4.

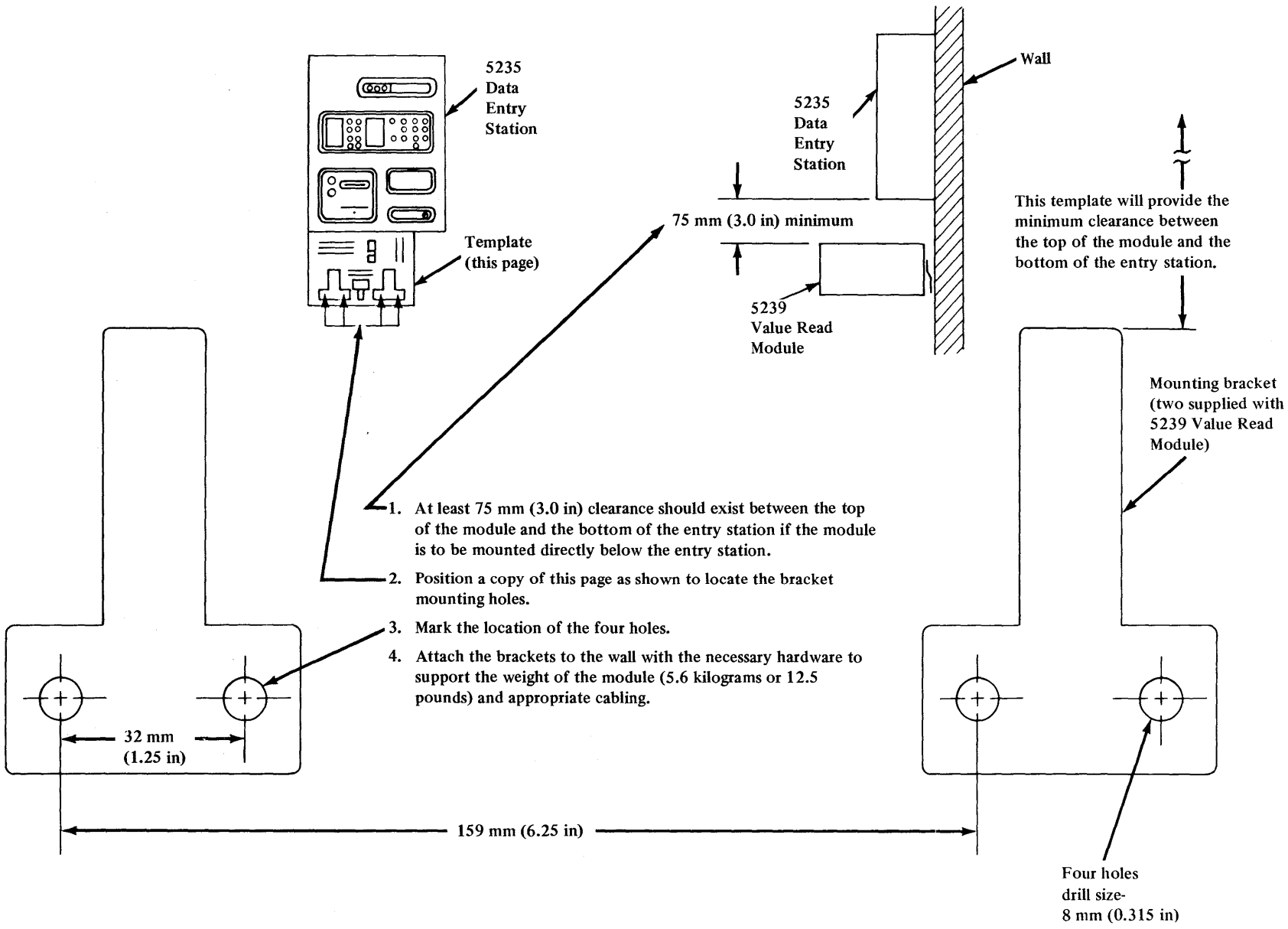


Figure 3-30. Template

External-Device Supplier Value Read Information

The following information can assist the supplier of the external device in understanding value read and what is necessary to ensure compatibility between the external device and the value read module.

The 5239 Value Read Module is a device for connecting customer scales, counters, switches, gauges, meters, keyboards, and other similar types of equipment to the 5235 or 5236 Data Entry Station. The 5239 module can be used with:

- Newer electronic devices having BCD/TTL parallel outputs
- Older electromechanical devices having 1-of-10 dry contact output

Figure 3-31 shows a typical value read installation. The customer device 1 attaches to the IBM 5239 Value Read Module 3 at a customer-supplied termination point, such as a terminal strip 2, or the external device can attach directly to the module with the installation of a connector (Amphenol or Cinch part number 57-30500 or equivalent) to the end of the cable from the external device.

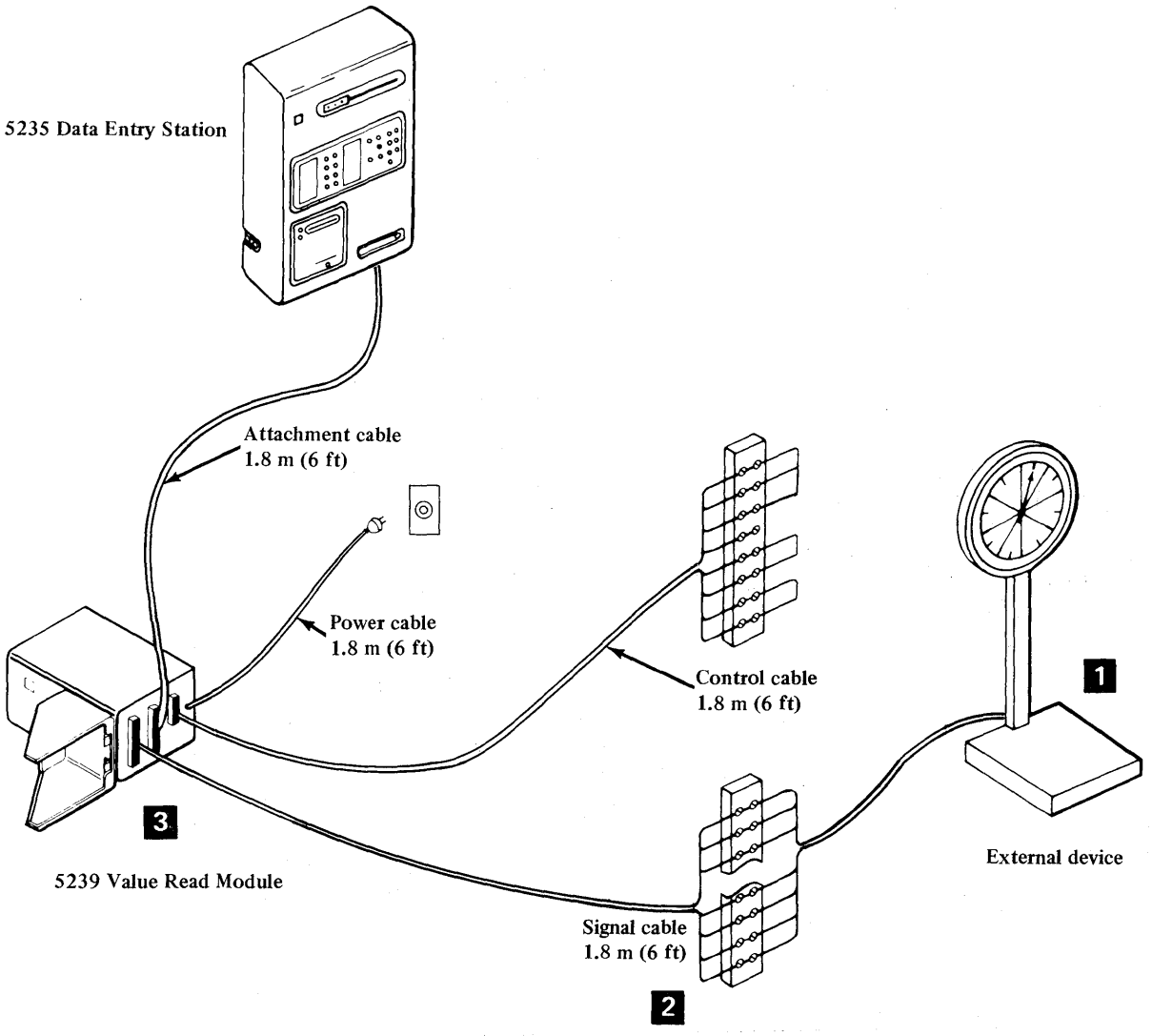
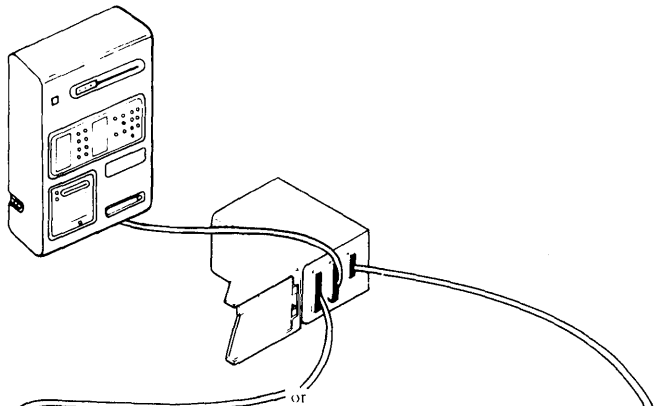


Figure 3-31. Value read installation

External Device Signals

The signals from the external device enter the module via the signal cable.

Refer to Figure 3-32 for the signal names and the pin/wire number for each line in the BCD/TTL parallel or 1-of-10 dry contact input signal cable and the control cable.



or

BCD/TTL feature signal cable

Pin/wire	Signal name	
46	Bit 1	Digit 1
45	Bit 2	Digit 1
44	Bit 4	Digit 1
43	Bit 8	Digit 1
29	Parity	Digit 1
42	Bit 1	Digit 2
41	Bit 2	Digit 2
40	Bit 4	Digit 2
39	Bit 8	Digit 2
28	Parity	Digit 2
38	Bit 1	Digit 3
37	Bit 2	Digit 3
35	Bit 4	Digit 3
25	Bit 8	Digit 3
30	Parity	Digit 3
24	Bit 1	Digit 4
20	Bit 2	Digit 4
23	Bit 4	Digit 4
22	Bit 8	Digit 4
21	Parity	Digit 4
19	Bit 1	Digit 5
15	Bit 2	Digit 5
18	Bit 4	Digit 5
17	Bit 8	Digit 5
16	Parity	Digit 5
14	Bit 1	Digit 6
10	Bit 2	Digit 6
13	Bit 4	Digit 6
12	Bit 8	Digit 6
11	Parity	Digit 6
8	Bit 1	Digit 7
5	Bit 2	Digit 7
7	Bit 4	Digit 7
6	Bit 8	Digit 7
9	Parity	Digit 7
3	Bit 1	Digit 8
32	Bit 2	Digit 8
2	Bit 4	Digit 8
1	Bit 8	Digit 8
4	Parity	Digit 8
26	External source in	
31	Inhibit out	
33	Data ready	
36	Ground (Note 2)	

Note 1

1-of-10 feature signal cable

Pin/wire	Signal name
1	Digit 1
2	Digit 2
3	Digit 3
4	Digit 4
5	Digit 5
6	Digit 6
7	Digit 7
8	Digit 8
9	Digit 9
10	Digit 0
15	Address 1
20	Address 2
19	Address 3
18	Address 4
17	Address 5
16	Address 6
13	Address 7
14	Address 8
37	External source in
48	Release in
50	Release out
33	Data ready
34	+24 V (Note 3)
36	Ground (*Do not* connect to external device)

Control cable

Pin/wire	Color	Signal name
19	Gray	No parity
7	Pink	No parity/continuous data ready tie down
16	Violet	Continuous data ready
1	Black	Protected in
2	Brown	Protected out
24	White	External source in
12	Orange	External source out
3	Tan	Auto enter in
4	Red	Auto enter out
15	Aqua	Action key 7 active
13	Yellow	Action select
14	Blue	Action key 8 active

Notes:

1. **Digit 1 is always the highest order digit.**
2. **This line should be connected to the external device signal ground. It is also used as the external source out signal line.**
3. **This signal is used as the external source out signal.**

Figure 3-32. Signal cable and control cable

Signal Line Functions

For a description of the signal line functions, refer to the following tables:

BCD/TTL parallel signal cable

Signal lines	Signal description
Input data (32)	Used for input of eight digits of BCD data to the 5239.
Parity (8)	Used to input a parity bit for each digit.
Data ready	Indicates when the attached external device has a valid and stable output.
External source in	External signal used to initiate the semiautomatic or automatic mode. This signal can be input to the 5239 at the control cable.
Inhibit out	Prevents output changes in the external device during a value read.
Signal ground	Used as a reference level for signal lines and the external source signal.

1-of-10 dry contact signal cable

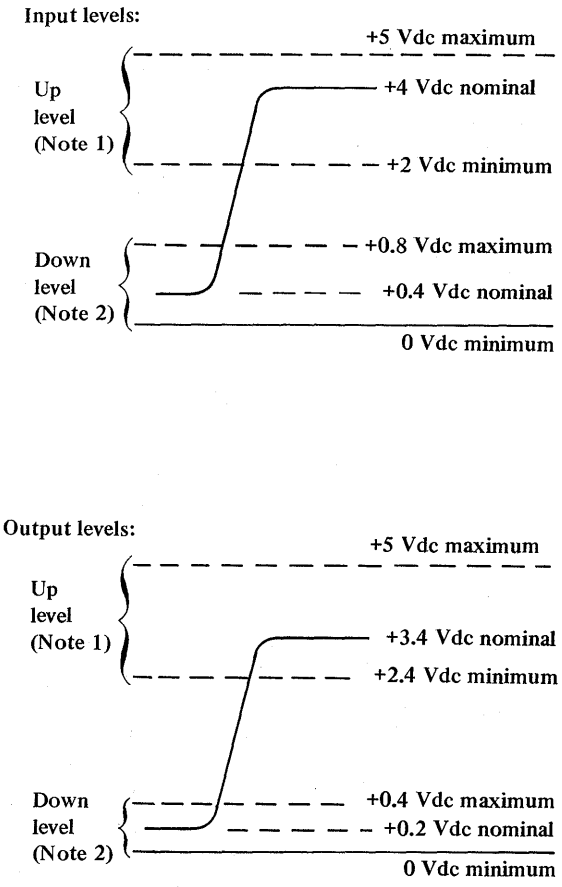
Signal lines	Signal description
Input data (10)	Used for decimal (1-of-10) digit input to the 5239.
Address (8)	Used for sequential access of data from the external device.
Release in	Signal from the external device to the 5239.
Release out	Signal returned to the external device following a successful value read.
External source in	External signal used to initiate the semiautomatic or automatic mode. This signal can be input to the 5239 at the control cable.
Data ready	Indicates when the external device has a valid and stable output.
24 volts	Used by the external device for the 'data ready' signal and 'external source in' signal.

Signal Levels for BCD/TTL Parallel Operation

The BCD/TTL parallel feature requires the input voltage to the 5239 module to be within the TTL voltage limits. See Figure 3-33 for the TTL voltage limits.

The 'input data' and 'parity' lines are up-level active. For example, an up level of the 4- and 1-bits in digit 1 represent a value of five. The 'inhibit out' signal is down-level active. The 'data ready' signal is down-level active. A down level 'data ready' signal indicates a data ready condition to the 5239 Value Read Module.

The 'external source in' signal is down-level active. This signal is the result of: (1) a dry-contact closure of the 'external source in' line to the 5239 signal ground line for a minimum of 40 milliseconds after contact bounce has stopped or (2) supplying a TTL down-level signal for a minimum of 40 milliseconds to the 'external source in' line.



Notes:

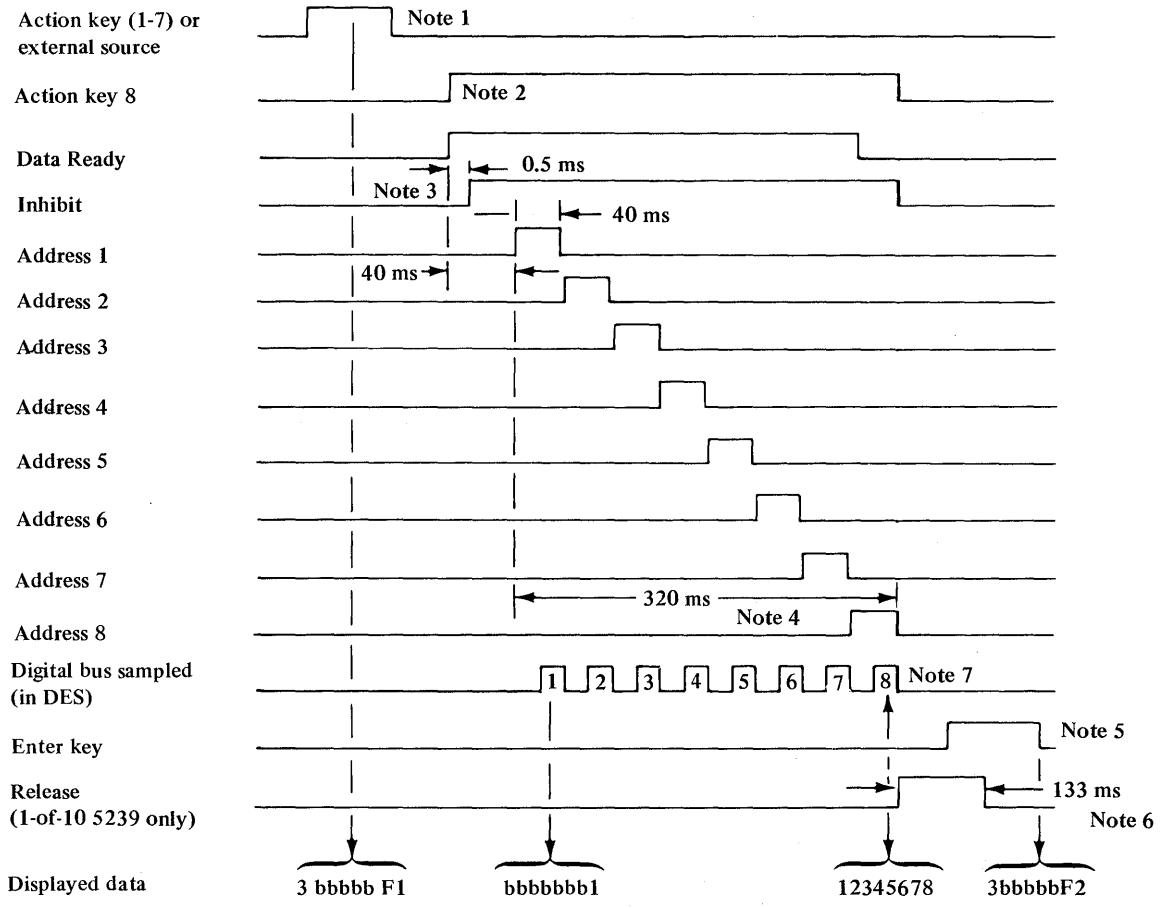
1. At an up level, the driver must supply (source) approximately 50 microamperes.
2. At a down level, the driver must accept (sink) approximately 1.6 milliamperes.

Figure 3-33. TTL voltage limits

External Device Timing Considerations

The timing chart in Figure 3-34 shows a typical value read operation and the timing of the attachment circuitry.

Note: The signal levels are shown for reference only and are not representative of the signal levels in the attachment circuitry.



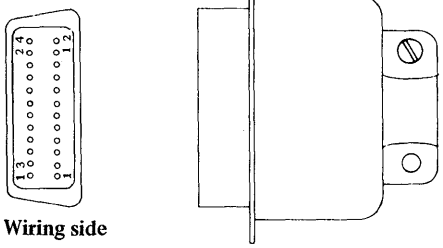
Notes:

1. External source activation (40 ms minimum duration) will cause either 7, F1 or 8, F1 to appear on the entry station display, depending on the control cable jumpering options.
2. Action key 8 and data ready are ANDed functions, and approximately 40 milliseconds after these two conditions are satisfied, the first digit will be addressed. Manual operation of action key 8 is not required for initiation of semiautomatic or automatic mode. Action key 8 will activate approximately 250 milliseconds (minimum) after pressing the action key (1–7) or after the external source in signal becomes active.
3. The inhibit line is activated 0.5 millisecond after the action key 8 and data ready lines are activated. It is deactivated after address 8 pulse is ended. But, if the parity check function is used, it is deactivated at the same time a parity check is detected.
4. The total sequential addressing time from address 1 through 8 is 320 milliseconds.
5. With external source and auto enter selected, the enter key is a 150-millisecond pulse generated by the value read attachment circuitry after address 8 scanning is completed.
6. The 1-of-10 feature activates the release relay in the module for 133 milliseconds ±1 millisecond at 60 Hz (160 milliseconds ±2 milliseconds at 50 Hz) after the fall of the inhibit line.
7. The external device must have the data stable (no changes) during the last 20 milliseconds of the address pulses to ensure proper reading.

Figure 3-34. Value read timing chart

Signal Cable and Control Cable Plugs

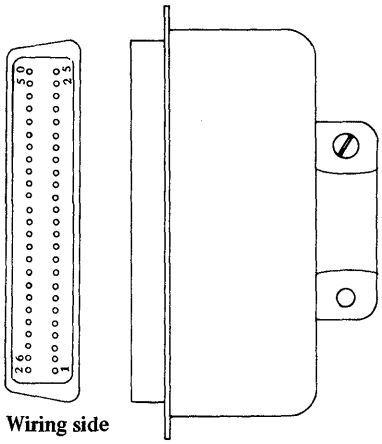
The plugs shown in Figure 3-35 connect to the mating receptacle located on the 5239 Value Read Module.



Wiring side

Control cable - 24-pin plug:

Amphenol - 57-30240;
Cinch - 57-30240; or equivalent



Wiring side

Signal cable - 50-pin plug:

Amphenol - 57-30500;
Cinch - 57-30500; or equivalent

Figure 3-35. Signal cable and control cable plug

Attaching Multiple External Devices

The module can accept a single device supplying up to eight digits or up to eight separate devices, with each device supplying only one digit. The only requirement is that each external device must be compatible with the feature of the 5239 module (BCD/TTL parallel or 1-of-10 dry contact) and that the control lines must be activated from only one device.

Value Read Module Checks

The 5239 module checks for an odd-bit parity per digit. If the external device does not supply parity, an option is available (at the control cable) to select the no-parity function. When this option is selected, the module does not do parity checking.

Entry Station Displays for External Devices

Figure 3-36 shows a typical BCD installation with a four-position scale and a three-position counter. The counter output is attached to the three low-order positions of the 5239 module (positions 6, 7, and 8). The scale is attached to positions 2, 3, 4, and 5.

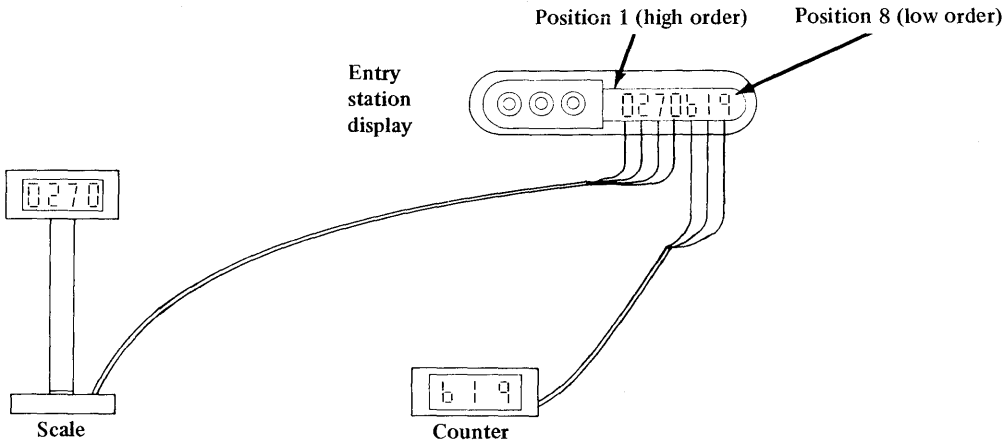


Figure 3-36. BCD device display positions

The value displayed at the external device is always displayed right-justified at the entry station. For example, if the value at the counter is changed to 019 and the scale value is not changed, the display indicates the value shown in Figure 3-37. However, if the BCD input lines (position 6) from the counter to the 5239 module are disconnected, the display indicates the values shown in Figure 3-38. It is not possible to have a blank display position between two sets of values. The high-order positions always right-justify to fill the unused low-order positions.

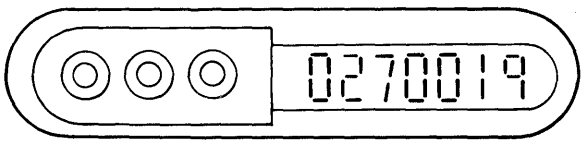


Figure 3-37. BCD device display

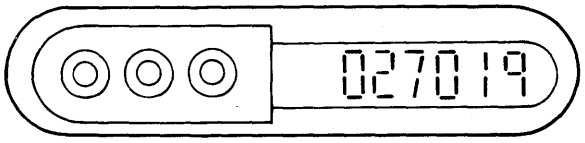


Figure 3-38. BCD device right-justified display

Figure 3-39 illustrates a typical 1-of-10 installation with a three-position counter and a three-position scale. The output of the scale is attached to the three low-order positions of the module (address lines 6, 7, and 8). The counter is attached to address lines 3, 4, and 5.

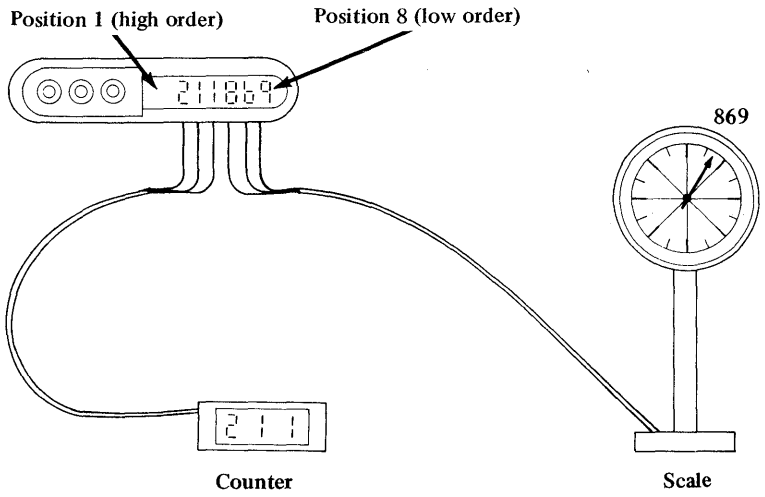


Figure 3-39. 1-of-10 device display positions

The value shown in Figure 3-40 is displayed when the value at the scale changes from 869 to 069.

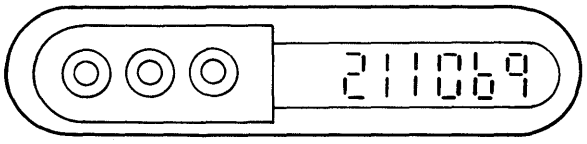


Figure 3-40. 1-of-10 device display

Figure 3-41 illustrates the value displayed when an address line is disconnected (in this example, address line 6) from the input to the module.

The illustration in Figure 3-41 shows that it is not possible to have a blank display position between two sets of values. The high-order positions always right-justify to fill the unused low-order positions.

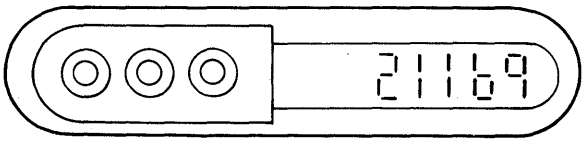


Figure 3-41. 1-of-10 device right-justified

Converting to the IBM Series/1 Data Collection Interactive System

Conversion requires the attachment of the external device to the value read module at the signal cable. Refer to Figure 3-42 for the pin connections required for the conversion. The customer is responsible for determining the exact pin connections, based on the installation configuration.

Note: The IBM 357 and 1030 data collection systems have 12 address lines, and the IBM 2790 data collection system has 10 address lines to allow reading digits from the external device. Figure 3-42 shows connections from the eight high-order address positions of the 357, 1030, and 2790 to the eight address positions of the 5239.

Signal cable		Cable to external device			
		357	1030	2790	
Signal	Pin	Pin	Pin	Pin	Wire color
Digit 1	1	A	A	B	Brown
Digit 2	2	B	B	C	Red
Digit 3	3	C	C	D	Orange
Digit 4	4	D	D	E	Yellow
Digit 5	5	E	E	F	Blue
Digit 6	6	F	F	H	Violet
Digit 7	7	G	G	J	Gray
Digit 8	8	H	H	K	White
Digit 9	9	J	J	L	Aqua
Digit 0	10	K	K	A	Black
Address 1	15	Z	Z	P	Black/white
Address 2	20	X	X	R	Black/red
Address 3	19	W	W	S	Black/orange
Address 4	18	V	V	T	Black/yellow
Address 5	17	U	U	U	Black/gray
Address 6	16	T	T	V	Brown/white
Address 7	13	S	S	W	Brown/red
Address 8	14	R	R	X	Brown/orange
Data ready in	33	a	a	M	Tan
24 V	34	b	b	N	Pink
Release in	48	e	e	a	Red/white
Release out	50	f	f	b	Red/orange
Inhibit out	31	Not used in these machines			
External source in	37	Not used in these machines			

Figure 3-42. Signal cable conversion table

procedures for problem determination.

Operating the Data Entry Station

The operation of the data entry stations, shown in Figures 4-1 and 4-2, is described as follows:

- Power on/off switch
- Status indicators
- Action keys
- Numeric keys
- Card reader
- Badge reader
- Mode switch

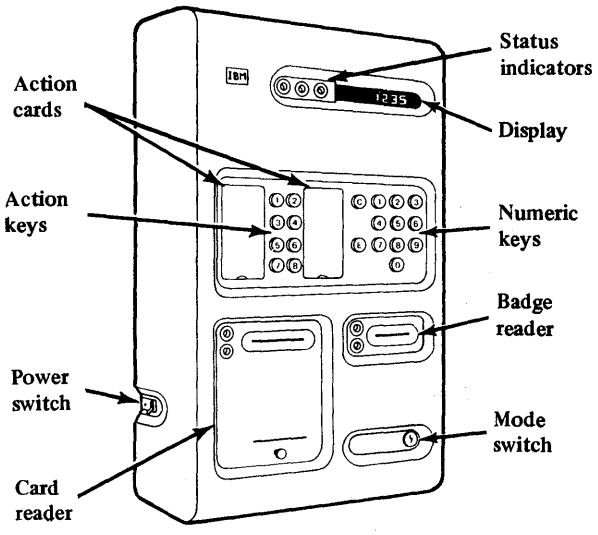


Figure 4-1. 5235 Data Entry Station

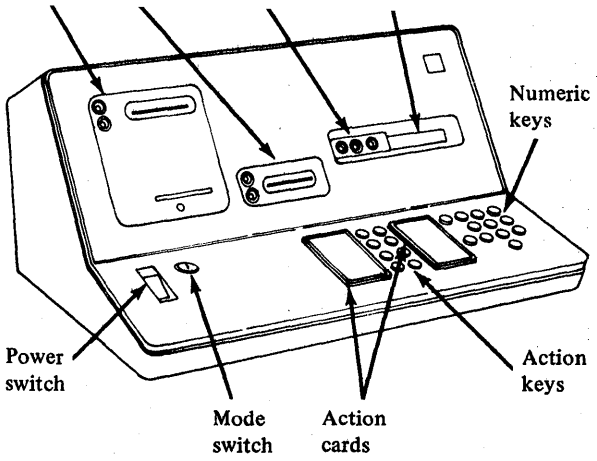


Figure 4-2. 5236 Data Entry Station

Power On/Off Switch

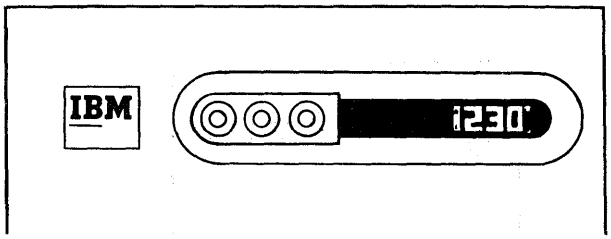
The Power on/off switch must be in the *1*-position (on) any time the data entry station is used. After power is turned on and the Series/1 is operable, the data entry station has all dashes in the display and all indicator lights are on. After approximately five seconds, the lights go off, the green status indicator on the status indicator panel remains on, and the display indicates the time of day. You are now ready to use the action keys.

Status Indicators

The three status indicators near the top of the data entry station, when on, indicate:

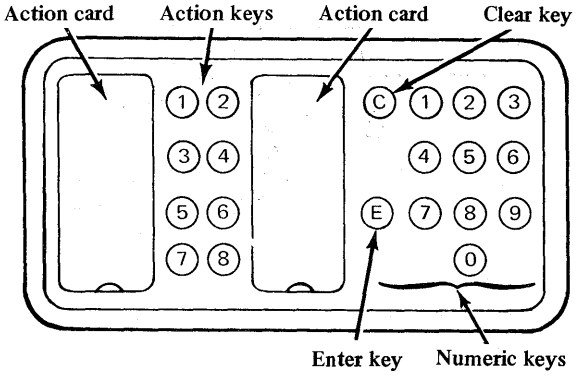
Green—The entry station is ready for you to select an action.
Yellow—An action key has been pressed, but the action is not yet completed.
Red—One of the following:

- The loop was stopped when the action key was pressed; the loop should be restarted.
- The action key pressed is not defined for this station.
- The requested action requires that the mode switch be in the supervisor position.
- The action is being cancelled.



Action Keys

As shown here, there are eight action keys located on the left side of the keyboard panel.



To the left and right of these keys are action cards that you create, naming the action for each key. The actions are explained in Appendix A.

The green status indicator must be turned on to select an action. If the green status indicator is on, select the action required and press the action key. The Series/1 responds by turning on the yellow status indicator. The number of the action key you pressed is shown in the leftmost digit of the display. The first entries you must make for this action are now indicated to you as follows:

- For key entry or value read, the time of day disappears and F1 appears in the right side of the display.
- For card entry, the green card insert indicator turns on at the card reader.
- For badge entry, the green badge insert indicator turns on at the badge reader.

If more than one badge entry is required for the action, the badge insert indicator comes on after all other entries are completed. After the required number of badges have been entered, the enter key (E) must be pressed to complete the action. When you have completed all entries for an action, the yellow status indicator turns off and the green status indicator turns on. The data entry station is then ready for the next action.

If you select an action that you have not defined or have incorrectly defined for the entry station, the green and red status indicators both turn on. Check the action definition record to ensure the correct definition of the action for that entry station.

Numeric Keys

There are 10 numeric keys (0–9), one clear key (C), and one enter key (E) located to the right of the action keys. Three key-entry fields can be designated for an action. An F1, F2, or F3 appearing in the right side of the display indicates that you must make a key entry. Do not attempt to enter key data or value read data until the F1, F2, or F3 indication appears in the display. Use the numeric keys to enter the data. As you enter the data, it appears in the display. If the data you entered is correct, press the enter key.

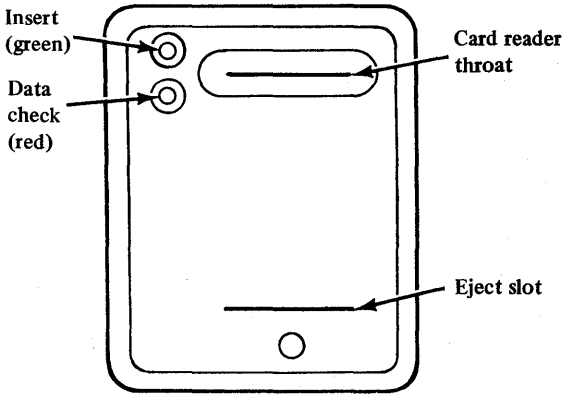
Cancelling Actions

If the data is entered incorrectly, press the clear key to clear the display; this clears only the key entry in progress. You can then reenter the data. The clear key also has another purpose. If there is no key-entered numeric data and the action is not completed, the clear key cancels all badge and card data entered for the action, and returns the entry station to a ready condition. Actions may also be cancelled by pressing the enter key when F1, F2, or F3 is not in the display.

Card Reader

The card reader has two front panel indicators:

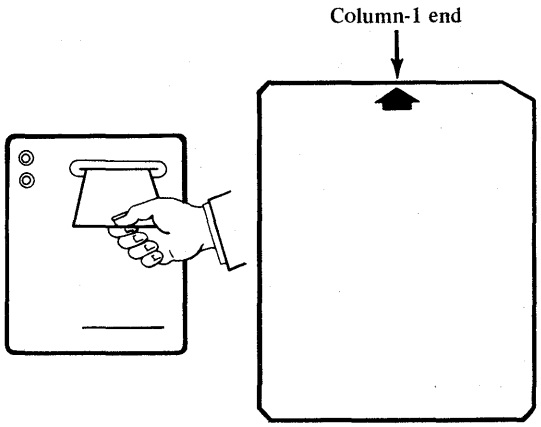
- Insert (green)
- Data check (red)



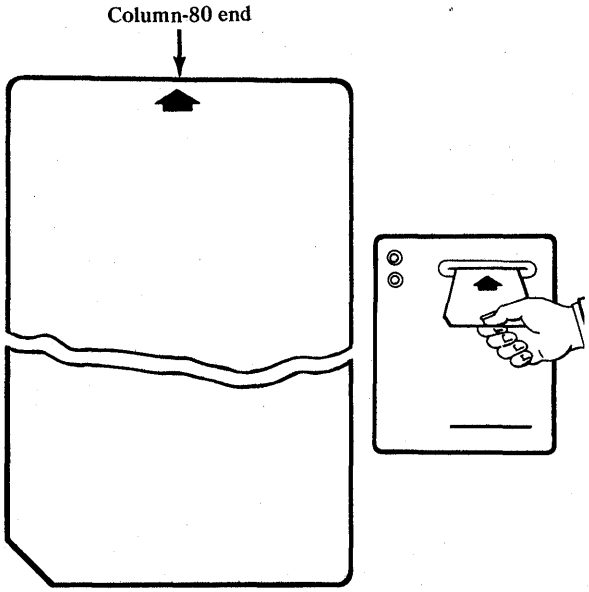
If the green insert indicator is on, it signals the operator that the action requires card entry.

Your data entry station may be equipped with one of the two card reader options: 96-column card reader or 80-column card reader.

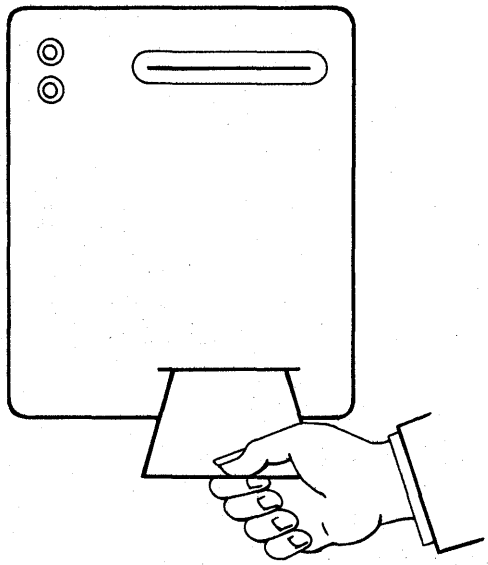
The 96-column card is inserted face up, column-1 end first.



The 80-column card is inserted face up, column-80 end first. Printing an arrow on the cards helps to show operators the proper way to insert cards.



When you insert the card into the card reader throat, it is pulled into the reader and disappears from view. When the card has been read, the leading edge appears at the eject slot. Remove the card from the reader after the card has stopped moving.



After the card has been read and accepted by the Series/1, the insert indicator goes off. If the insert indicator comes on again, it indicates that another card is required for that action.

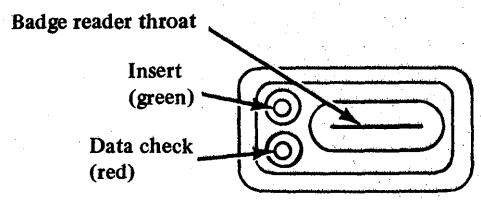
If the insert indicator *remains* on after the card has been read, it indicates that the card was read incorrectly; reinsert the card.

If the red data check indicator comes on, it indicates that the card check character is different than the one you defined for the action you are using. Insert the correct card or insert the card correctly. The data check indicator remains on until a card is inserted.

Badge Reader

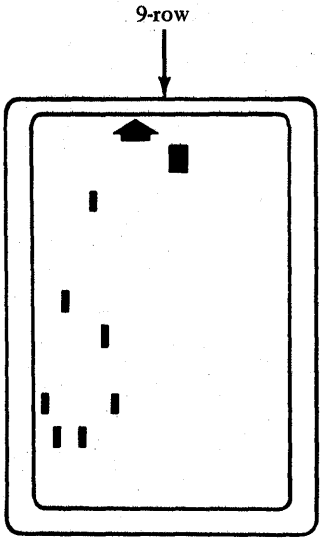
The badge reader has two front panel indicators:

- Insert (green)
- Data check (red)



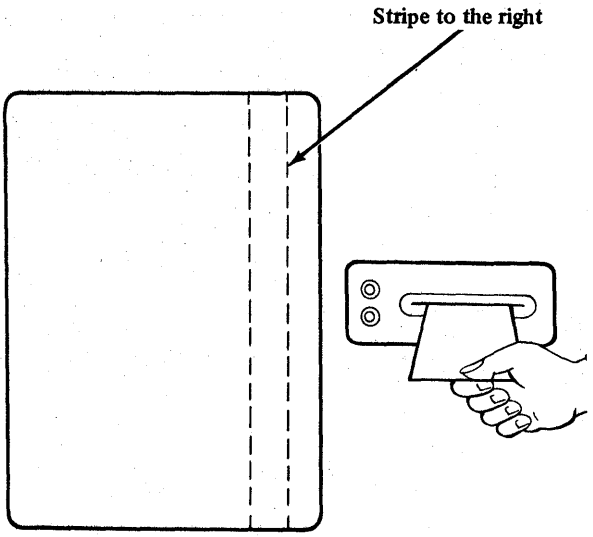
If the green insert indicator is on, it indicates to the operator that the action requires one or more badge entries.

Your entry station may be equipped with one of the two badge reader options: punched hole badge reader or magnetic stripe badge reader. The punched hole badge is inserted 9-row first, with the punched section of the badge to the operator's left.



Punched badge

The magnetic stripe badge is inserted with the magnetic stripe on the bottom and to the operator's right. IBM standard Series/1 Data Collection Interactive badges have an arrow printed on the badge to indicate how the badge should be inserted.



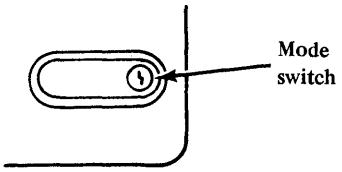
Magnetic stripe badge

When the insert indicator comes on, insert the badge into the badge reader throat, pushing it in all the way in one easy motion. When the insert indicator light goes out, the badge entry is completed. If the audible indicator feature is installed, a tone sounds to indicate completion of the badge entry. If the insert indicator light does not go out, remove the badge and reinsert it. When the insert indicator light goes out and then turns back on, another badge can be entered. After entering the last badge for an action that allows more than one badge, press the enter key to complete the action.

The red data check indicator light might turn on after you insert the badge. This indicates that the badge check character is different than the one you defined for the action you are using; insert the correct badge. The data check indicator remains on until another badge is inserted.

Mode Switch

The mode switch has three positions and two keys. One key is for the supervisor to use, as defined by your action, and one is for testing.



The mode switch *with the key removed* is always in a vertical position. This is the normal operating position, and it is the only position that the mode switch can be in to remove the key.

The supervisor key turns clockwise only, and cannot be removed from the mode switch until it is returned to the normal operating position. This key is used by a supervisor to authorize certain actions. See Appendix A.

The test key turns counterclockwise only, and cannot be removed from the mode switch until it is returned to the normal operating position. This key puts the data entry station in test condition. See "Problem Determination Guide" in this chapter.

Operating the Time Entry Station

There are two time entry station models: one for punched hole badge and one for magnetic badge (see Figure 4-3). Each is equipped with a time-of-day display. An additional feature, which sounds an audible tone when the badge is read successfully, is available.

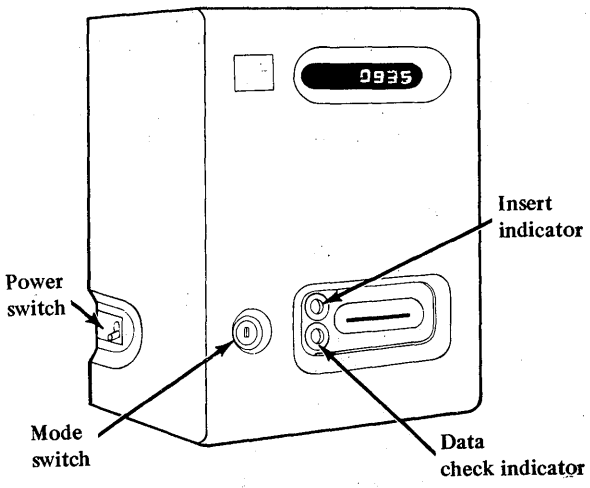


Figure 4-3. 5234 Time Entry Station

The punched hole badge is inserted 9-row first, with the punched section of the badge to the operator's left. The magnetic stripe badge is inserted with the magnetic stripe on the bottom and to the operator's right.

When the insert indicator comes on, insert the badge into the badge reader throat, pushing it in all the way in one easy motion. The insert indicator goes out and turns back on again, indicating that the badge entry was completed and another badge can be entered. If the audible indicator feature is installed, a tone sounds to indicate completion of the badge entry. If the insert indicator does not go out or if the audible tone does not sound, remove the badge and reinsert it.

The data check indicator might turn on after you insert the badge. This indicates that the badge data check character is different than the one you defined for the action you are using; insert the correct badge.

If no time is displayed or if the ready indicator either does not turn on or it flashes, some entry other than badge entry may be erroneously specified for the time entry station. Correct the action definition record for the entry station if this condition exists.

Operating the Value Read Module

There are no functional units in the value read module that require operator actions to initiate the value read operation. Options that control the module are made during installation. (For installation options, refer to Chapter 3.)

Backup Procedures

Your Series/1 Data Collection Interactive has been designed for performance and reliability. At times, however, your system or certain entry stations on your system might fail to work properly. Some possible conditions causing this are:

- Power failure
- Relocation of loops or entry stations
- Removal of an entry station, causing distance between operating entry stations to be greater than 610 m (2000 ft)
- Series/1 maintenance

When one or more entry stations of the system fail, a backup procedure is required to record the actions. This backup procedure varies, depending on your application.

One common backup procedure is to have a form beside each entry station. This form is in exactly the same format as the data appears in the buffer. These manually created records can then be processed by your computer system.

If the correct time for each action is not critical, actions can be accumulated for entry when the system starts working again.

Power Interruption

If a power failure is experienced by the Series/1, an initial system restart procedure must be executed to ensure proper system operation and data integrity.

Power outages at the Series/1 can also cause a loss of data if:

- Badge records are in the badge buffer at the time of the failure.
- Data records entered have not yet been punched into cards or written on the diskette.

Reenter all actions that occurred just before the power failure.

Problem Determination Guide

When you suspect an entry station problem, follow this procedure to determine if you have a failing entry station, station connector, loop wiring, or Series/1:

Is there a loop status message indicated at the Series/1 display station (1XXX, 2XXX, 3XXX or 4XXX)?

Yes No

Go to the failing entry station.

Is the time of day displayed?

Yes No

Go to ©

Entry station checkout procedure.

Note: For an explanation of what each action key does and how to test it, see "Action Key Test" in this chapter.

Turn mode switch counterclockwise.

Are all indicators and all segments on?

Yes No

Replace entry station and take to Central Facilities Maintenance site.

Is this a time entry station (TES)?

Yes No

After 5 seconds:

1. Display 2ƀ ƀ ƀ ƀ ƀF1.
2. Badge light is on.
3. IPL and restart.

Go to Ⓐ

After 5 seconds:

1. Display is blank.
2. Badge light is on.

Go to Ⓐ

Go to Ⓑ

Ⓐ **Is display correct?**

Yes No

Is value read attachment feature installed in entry station?

No Yes

Go to Value Read Tests.

Replace entry station and take to Central Facilities Maintenance site.

Is entry station a time entry station?

Yes No

Go to Ⓓ

Go to Ⓖ

Ⓑ **Is the status message displayed XE01, XE02, XE03, or XE04 (X = loop number—1, 2, 3, or 4)?**

Yes No

Is the status message displayed an XE05?

Yes No

Go to Ⓚ

Ready an output unit and restart system.

1. Power off system
2. Power on system

Did error recur?

Yes No

Return to normal use.

Call IBM service.

© Verify that you have:

1. Line cord plugged
2. AC line voltage
3. Signal cable plugged
4. Power on
5. Mode switch in normal position

Are 1–5 correct?

Yes No

Correct what was wrong.

Is value read attachment feature installed in entry station?

No Yes

Go to "Value Read Tests" in this chapter.

If spare entry station available, replace entry station.

Does new entry station have time of day displayed?

Yes No

Replace station connector for this entry station.

Take replaced entry station to Central Facilities Maintenance site.

Ⓓ Keyboard Test

In test mode, press any key several times. Note that when a key is pressed, the keyed number lights and shifts across display. When a key is pressed nine times, the display resets to F1.

Does keyed number light and shift across display?

Yes No

Is value read attachment feature installed in the entry station?

No Yes

Go to "Value Read Tests" in this chapter.

Replace entry station and take to Central Facilities Maintenance site.

Were all keys pressed?

Yes No

Go to Ⓓ

Key in any combination of numbers.

Press enter key (E) once.

Note field requested (F1, F2, or F3).

Does key field clear and F1 increment to F2, F2 increment to F3, or F3 increment to F1?

Yes No

Is value read attachment feature installed in the entry station?

No Yes

Go to "Value Read Tests" in this chapter.

Replace entry station and take to Central Facilities Maintenance site.

Press numeric key 2. Press clear key (C) once.

Did display state the same?

Yes No

Is value read attachment feature installed in the entry station?

No Yes

Go to "Value Read Tests" in this chapter.

Replace entry station and take to Central Facilities Maintenance site.

End of keyboard test. Begin action key test.

Ⓔ Action Key Test

In test mode, press action key 2.

Is display 2ƀƀƀƀƀF1?

Yes No

Replace entry station and take to Central Facilities Maintenance site.

Press another action key.

Does display change (2ƀƀƀƀƀF1 go away)?

Yes No

Replace entry station and take to Central Facilities Maintenance site.

Have all action keys been pressed?

Yes No

Go to Ⓔ

Is value read attachment feature installed in the entry station?

No Yes

Is problem with reading an external value?

No Yes

Go to "Value Read Tests" in this chapter.

Go to Ⓕ Card/Badge Reader Test

End of data entry station action key tests. Begin card/badge reader test.

Ⓕ Card/Badge Reader Test

Does the entry station have either a card reader or badge reader or both?

Yes No

Replace entry station with a spare. If no fix, replace station connector box (SCB).

In test mode, insert test card/badge.

Does green insert indicator go off?

Yes No

If spare entry station available, replace entry station.

Did new entry station correct problem?

No Yes

Take original entry station to Central Facilities Maintenance site.

Replace station connector box (SCB).

Does the entry station have the audible indicator or contacts closure feature installed?

Yes No

Go to Ⓗ

Is only the audible indicator feature installed?

No Yes

Does the audible indicator sound when the green insert indicator goes off?

Yes No

Replace entry station and take to Central Facilities Maintenance site.

Go to Ⓗ

Go to Ⓖ

Ⓖ **Does the contacts closure relay activate when the green insert indicator goes out?**

No Yes

Is the audible indicator installed?

Yes No

Go to Ⓗ

Does the indicator sound when the green insert indicator goes out?

Yes No

Replace the entry station and take to Central Facilities Maintenance site.

Go to Ⓗ

Replace the contacts closure connector and rerun test Ⓕ.

Does contacts closure relay still fail?

No Yes

Replace entry station and take to Central Facilities Maintenance site.

The original contacts closure connector is defective; order a replacement. Go to Ⓗ.

Ⓗ The reader is working properly; check source card for damage, off-registration, defects, etc.

End of card/badge reader test.

(K)

Is the IBM EDX operating system together with the program RPQ for this device used?

Yes No

Is your program capable of executing the wrap test?

Refer to the "Test Loop Operation" in Chapter 2, which shows how the test loop operation is used in conjunication with this procedure.

Yes No

Call IBM service.

(K1)

Execute your procedure.

Is it done?

Yes No

Go to (K1)

Go to (K3)

(K2)

Request function to wrap test selected loop, as follows:

1. Remove loop cable connector from selected loop multiplexer and install the "wrap jumper" in its place.
2. Press attention key (ATTN) on the Series/1 display station keyboard.
3. Enter "TST" into the keyboard and press enter key.
4. Enter loop number and device address of the scheduler into the keyboard when asked.

Is this all done?

Yes No

Go to (K2)

(K3) **Were there any errors?**

Yes No

Reinstall loop connector.

Is there only one entry station?

Yes No

Go to (L)

Replace entry station with a spare entry station.

Does new entry station have time of day displayed?

Yes No

Replace station connector with a spare. If entry station still does not indicate time of day, perform continuity and resistance checks on the loop.

Take replaced entry station to Central Facilities Maintenance site.

Call IBM service.

Ⓛ **Are all entry stations blank?**

Yes No

Are all entry stations solid dashes (not flickering?)

Yes No

Does any station have a constantly flickering display ("8's" with dashes superimposed)?

Yes No

Go to Ⓝ

Power off first station on loop that has a constantly flickering display (refer to Note on loop restriction at Ⓜ).

Do all remaining stations now display time-of-day?

Yes No

Go to Ⓛ

Replace last station that was powered-off. Take faulty station to Central Facilities Maintenance site.

Power off last entry station on loop.

Refer to Note on loop restriction at Ⓜ.

Do all remaining entry stations have time-of-day?

Yes No

Open loop from last entry station to Series/1 or a defective station connector for the last entry station. Replace station connector with spare unit. If entry station still does not indicate time of day, perform continuity and resistance checks on loop segment.

Replace last entry station.

Go to Ⓜ

Does new entry station have time of day?

Yes No

Replace station connector for this entry station.

Take replaced entry station to Central Facilities Maintenance site.

Ⓜ Power off first entry station.

Note: There is a 610-m (2000-ft) loop restriction between operating stations on the loop. If you power off one entry station and the loop distance exceeds 610 m (2000 ft), you will induce additional errors into the loop. In the cases where the resultant loop distance is greater than 610 m (2000 ft), replace the powered-off station with a known working station to continue the test.

Do all remaining entry stations have time-of-day?

Yes No

Open loop from Series/1 to first entry station or a defective station connector for the first entry station. Replace station connector with a spare. If entry station still does not indicate time-of-day, perform continuity and resistance checks on loop segment.

Replace first entry station.

Does new entry station have time of day?

Yes No

Replace station connector for this entry station.

Take replaced entry station to Central Facilities Maintenance site.

Ⓝ Determine last entry station with dashes and first entry station without dashes.

Power off first entry station without dashes.

Refer to Note on loop restriction at Ⓜ.

Do all remaining entry stations have time-of-day?

Yes No

Power on this entry station.

Power off last entry station with dashes.

Refer to Note on loop restriction at Ⓜ.

Do all remaining entry stations have time-of-day?

Yes No

Open loop between last entry station with dashes and first entry station without dashes or either of the station connectors.

Replace station connectors.

If entry station does not indicate time-of-day, perform continuity and resistance checks on loop segment.

Ⓞ Replace powered-off entry station.

Does new entry station have time-of-day?

Yes No

Replace station connector for this entry station.

Take replaced entry station to Central Facilities Maintenance site.

Go to Ⓞ

Action Key Test

The action key test is used with the mode switch turned to test, to determine if the input request is correct. Definitions of the action keys are as follows:

1 Pressing this key causes all indicators and all segments of the display to light.

2 Pressing this key allows entry of data by badge, card, or numeric keys; this data is stored in the data buffer.

3 Pressing this key displays the first four positions of the badge field stored in the buffer. These four positions are displayed in coded form.

4 Pressing this key displays the first four positions of the card field stored in the buffer. These four positions are displayed in coded form.

5 Pressing this key displays the first four positions of the header stored in the buffer. These four positions are displayed in coded form.

6 Pressing this key changes the coded display to numeric and displays eight positions; the first four positions are the four positions displayed when the 3, 4, or 5 key was pressed.

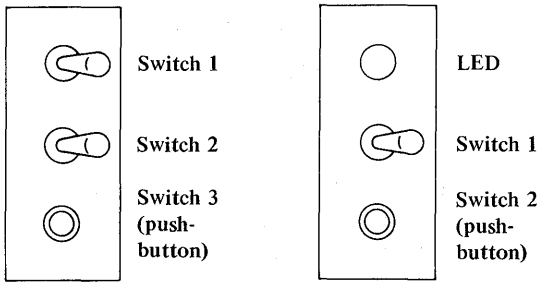
7 Pressing this key scans the buffer backwards. The position in the buffer that preceded the previous display moves into the first position of the display; the other three positions each shift to the right.

8 Pressing this key scans the buffer forward. The position in the buffer that followed the previous display moves into the last position of the display. The other three positions each shift to the left. (This means that if the previous display was positions 1–4, pressing the 8 key displays positions 2–5.)

Coded display	Character	Coded display	Character	Coded display	Character	Coded display	Character	Coded display	Character
C1	A	d4	M	E8	Y	4A	¢	60	– (minus)
C2	B	d5	N	E9	Z	4b	.	61	/
C3	C	d6	O	F0	Ø	4C	<	6b	, (comma)
C4	D	d7	P	F1	1	4d	(	6C	%
C5	E	d8	Q	F2	2	4E	+	6d	– (underscore)
C6	F	d9	R	F3	3	4F	|	6E	>
C7	G	E0	\	F4	4	50	&	6F	?
C8	H	E2	S	F5	5	5A	!	7A	:
C9	I	E3	T	F6	6	5b	$	7b	#
d0	}	E4	U	F7	7	5C	*	7C	@
d1	J	E5	V	F8	8	5d	)	7d	' (apostrophe)
d2	K	E6	W	F9	9	5E	;	7E	=
d3	L	E7	X	40		5F	¬	7F	" (quote)

Value Read Tests

Before beginning the checkout of value read, determine which feature is installed in the module: BCD/TTL parallel or 1-of-10 dry contact input. Examine the 50-pin wrap plug stored in the cover of the module. The BCD feature has a plug with two toggle switches and a pushbutton; the 1-of-10 feature has a plug with one toggle switch, a pushbutton, and a light emitting diode (LED). (See Figure 4-4.)



BCD data wrap plug (50-pin)

1-of-10 data wrap plug (50-pin)

Figure 4-4. Wrap plugs

INST Wrap Plug Installation

To perform the value read checkout procedure, plug the 50-pin signal wrap plug and the 24-pin control wrap plug into the 5239 module cable connectors, as shown in Figure 4-5, as follows:

1. Turn off the ac power switch on the 5239 module.
2. Remove the signal cable Ⓐ from the module.
3. Remove the control cable Ⓑ from the module.
4. Remove the 50-pin data wrap plug from the hinged cover on the module and plug it into the signal cable connector Ⓐ on the module.
5. Remove the 24-pin control wrap plug from the hinged cover on the module and plug it into the control connector Ⓑ on the module.

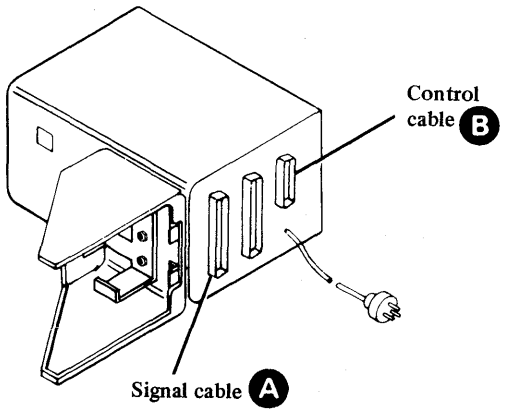


Figure 4-5. Value read module plug locations

Wrap Test Selection

1 **Did the failure occur during a manual operation?**

No Yes

Do you have the BCD feature?

Yes No

Go to BCD1 Go to 1-of-10A

Did failure occur during a manual protected operation?

No Yes

Do you have the BCD feature?

Yes No

Go to BCD2 Go to 1-of-10B

Did the failure occur during semiautomatic operation or automatic operation?

No Yes

Do you have the BCD feature?

Yes No

Go to BCD3 Go to 1-of-10C

Have you been at this question before?

No Yes

If you are unable to select the failing mode, begin testing the manual mode and proceed through the automatic mode of operation.

Return to **1** and retry selection of failing mode.

BCD1 Manual Mode Test

- Install the data wrap plug and the control wrap plug on the value read module as instructed at INST .
- Set the toggle switches on the data wrap plug and the control wrap plug as shown in Figure 4-6.
- Set entry station mode switch to normal mode.

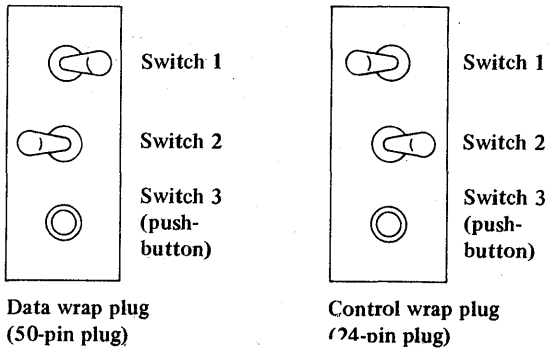


Figure 4-6. Manual mode wrap plugs for test 1

Are all switches positioned as shown in Figure 4-6?

Yes No

Go to BCD1

Press action key 1–7 that failed during manual operation.

Does display= X F1 ?

X=action key 1–7

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Press action key 8.

Does display= 05050505 ?

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Note: An output record may be created if the enter key is pressed.

Do you want to test the enter function even though you may create an output record?

Yes No

Press clear key twice.

Go to **2**

Press enter key.

2 **Does display= Time of Day ?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

3 Set the toggle switches on the data wrap plug and the control wrap plug as shown in Figure 4-7.

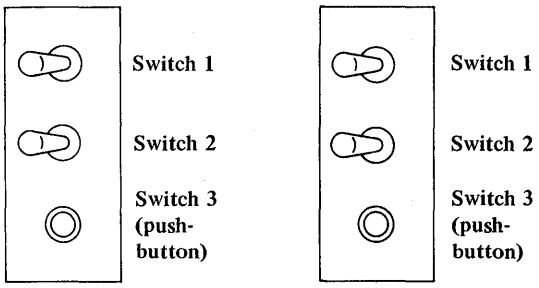


Figure 4-7. Manual mode wrap plugs for test 2

Are all switches positioned as shown in Figure 4-7?

Yes No
| Go to 3

Press action key 1–7 that failed during manual operation.

Does display= X F1 **?**

X=action key 1–7

Yes No
| Take entry station and value read module to the Central Facilities Maintenance site.

Press action key 8.

Does display= 50505050 **?**

Yes No
| Take entry station and value read module to the Central Facilities Maintenance site.

Note: An output record may be created if the enter key is pressed.

Do you want to test the enter function even though you may create an output record?

Yes No
| Press clear key twice.
| Go to 4

Press enter key.

4 **Does display=** Time of Day **?**

Yes No
| Take entry station and value read module to the Central Facilities Maintenance site.

5 Set the toggle switches on the data wrap plug and the control wrap plug as shown in Figure 4-8.

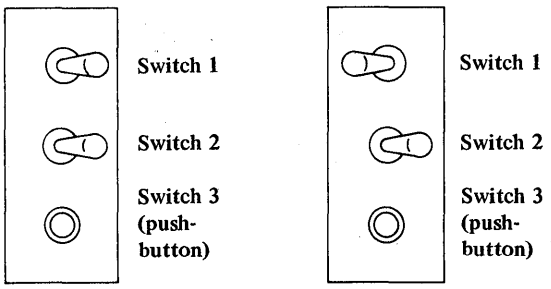


Figure 4-8. Manual mode wrap plugs for test 3

Are all switches set as shown in Figure 4-8?

Yes No
| Go to 5

Press action key 1–7 that failed during manual operation.

Does display= X F1 **?**

X=action key 1–7

Yes No
| Take entry station and value read module to the Central Facilities Maintenance site.

Press action key 8.

Does display= 0505 **?**

Yes No
| Take entry station and value read module to the Central Facilities Maintenance site.

Note: An output record may be created if the enter key is pressed.

Do you want to test the enter function even though you may create an output record?

Yes No
| Press clear key twice.
| Go to 6

Press enter key.

Does display= 0505 **?**

Yes No
| Take entry station and value read module to the Central Facilities Maintenance site.

Press clear key twice.

6 **Does display=** **Time of Day** **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

7 Set the toggle switches on the data wrap plug and the control wrap plug as shown in Figure 4-9.

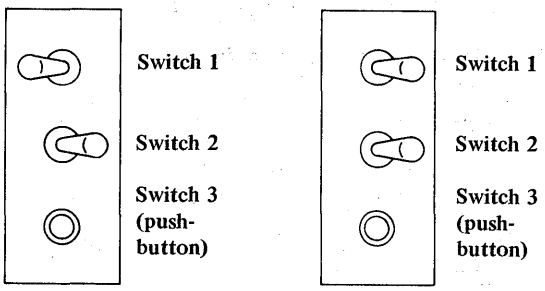


Figure 4-9. Manual mode wrap plugs for test 4

Are all switches set as shown in Figure 4-9?

Yes No

Go to **7**

Press action key 1–7 that failed in manual operation.

Does display= **X F1** **?**

X=action key 1–7

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Press action key 8.

Does display= **50505050** **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Note: An output record may be created if the enter key is pressed.

Do you want to test the enter function even though you may create an output record?

Yes No

Press clear key twice.

Go to **8**

Press enter key.

8 **Does display=** **Time of Day** **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

All tests of the manual mode circuitry have been completed. The problem is not in the 5239 module or the value read attachment in the entry station. The problem is either in the signal cable or external device.

Note: If the enter key function was skipped to avoid creating an output record and the problem being experienced is due to the enter function, take the entry station and value read module to the Central Facilities Maintenance site.

BCD2 Manual Protected Mode Test

- Install the data wrap plug and the control wrap plug on the value read module as instructed at INST .
- Set the toggle switches on the data wrap plug and the control wrap plug as shown in Figure 4-10.
- Set the entry station mode switch to normal mode.

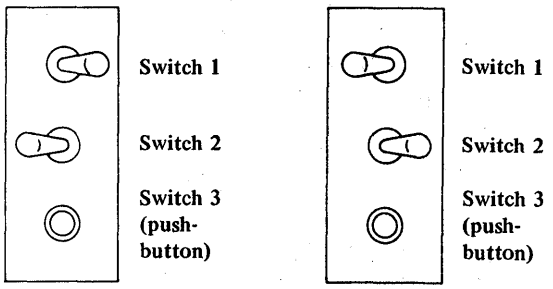


Figure 4-10. Manual protected mode wrap plugs

Are all switches positioned as shown in Figure 4-10?

Yes No
- No: Go to BCD2

Press action key 7.

Does display= 7 F1 ?

Yes No
- No: Take entry station and value read module to the Central Facilities Maintenance site.

Press numeric keys 1 through 0.

Does display= 7 F1 ?

Yes No
- No: Take entry station and value read module to the Central Facilities Maintenance site.

Press action key 8.

Does display= 05050505 ?

Yes No
- No: Take entry station and value read module to the Central Facilities Maintenance site.

Note: An output record may be created if the enter key is pressed.

Do you want to test the enter function even though you may create an output record?

Yes No
- No: Press clear key twice.
- No: Go to 9

Press enter key.

9 **Do you have a second key field (F2) personalized?**

Yes No
- No: **Does display= Time of Day ?**

  Yes No
  - No: Take entry station and value read module to the Central Facilities Maintenance site.

  10 Press action key 7

  Does display= 7 F1 ?

  Yes No
  - No: Take entry station and value read module to the Central Facilities Maintenance site.

  Press action key 8.

  Does display= 05050505 ?

  Yes No
  - No: Take entry station and value read module to the Central Facilities Maintenance site.

  Press clear key.

  Does display= 7 F1 ?

  Yes No
  - No: Take entry station and value read module to the Central Facilities Maintenance site.

  Press clear key.

Go to 11

Does display= `Time of Day` **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

All tests of the manual protected circuitry have been completed. The problem is either in the signal cable or in the external device.

Note: If the enter key function was skipped to avoid creating an output record and the problem being experienced is due to the enter function, take the entry station and value read module to the Central Facilities Maintenance site.

11 **Does display=** `7 F2` **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Press numeric keys 1 through 5.

Does display= `12345` **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Press clear key.

Does display= `7 F2` **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Press numeric keys 6 through 0.

Does display= `67890` **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Note: An output record may be created if the enter key is pressed.

Do you want to test the enter function even though you may create an output record?

Yes No

Press clear key twice.

Go to **12**

Press enter key.

12 **Does display=** `Time of Day` **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Go to **10**

BCD3 Semiautomatic and Automatic Mode Test

- Install the data wrap plug and the control wrap plug on the value read module as shown at INST .
- Set the toggle switches on the data wrap plug as shown in Figure 4-11.
- Set the entry station mode switch to normal mode.

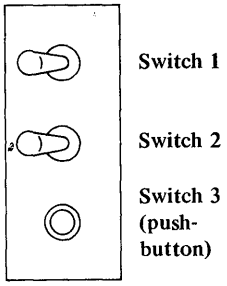


Figure 4-11. Data wrap plug switch positions for automatic mode test

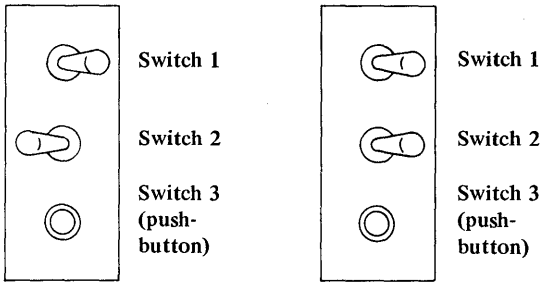


Figure 4-12. Control wrap plug switch positions for selecting action 7 or 8 for automatic mode test

Is action 7 personalized for semiautomatic or automatic operation?

Yes No

Set toggle switches on the control wrap plug for action 8 as shown in Figure 4-12.

Set toggle switches on the control wrap plug for action 7 as shown in Figure 4-12.

Note: An output record may be created if the enter key is pressed.

Do you want to test the automatic mode even though you may create an output record?

Yes No

Take the entry station and value read module to the Central Facilities Maintenance site.

Press and hold switch 3 (pushbutton) on the control wrap plug.

Does display= X F1 ?

X=7 or 8 (action personalized)

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Release switch 3 (pushbutton) on the control wrap plug.

Does display= X F2 ?

X=7 or 8 (action personalized)

Yes No

Did digits flash across display before displaying Time of Day ?

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Does display= Time of Day ?

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Go to 14

Did digits flash across display before displaying X F2 ?

X=7 or 8 (action personalized)

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Press clear key twice.

Does display= Time of Day ?

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Press and hold switch 3 (pushbutton) on signal wrap plug.

Does display= [X F1] **?**

X=7 or 8 (action personalized)

Yes No

Did digits flash across display before displaying [**Time of Day**] **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Does display= [**Time of Day**] **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Go to 14

Did digits flash across display before displaying [**X F2**] **?**

X=7 or 8 (action personalized)

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Go to 13

13 Press clear key twice.

Does display= [**Time of Day**] **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

14 All tests of the semiautomatic and automatic circuitry have been completed. The problem is either in the signal cable or in the external device.

Note: If the enter key function was skipped to avoid creating an output record and the problem being experienced is due to the enter function, take the entry station and value read module to the Central Facilities Maintenance site.

1-of-10A Manual Mode Test

- Install the data wrap plug and the control wrap plug on the value read module as instructed at INST .
- Set the toggle switches on the data wrap plug and the control wrap plug as shown in Figure 4-13.
- Set the entry station mode switch to normal mode.

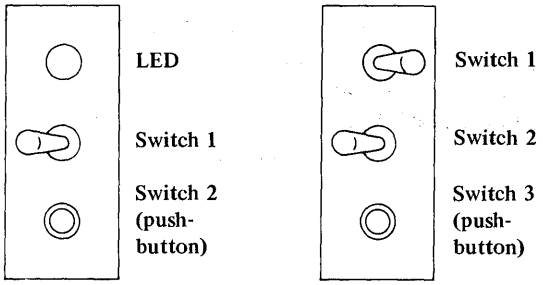


Figure 4-13. Manual mode wrap plugs for test 1

Are all switches positioned as shown in Figure 4-13?

Yes No
| Go to 1-of-10A

Press action key 1–7 that failed during manual operation.

Does display= X F1 ?

X=action key 1–7

Yes No
| Take entry station and value read module to the Central Facilities Maintenance site.

Press action key 8.

Does display= 78735690 ?

Yes No
| Take entry station and value read module to the Central Facilities Maintenance site.

Did the LED on the data wrap plug flash?

Yes No
| Take the entry station and value read module to the Central Facilities Maintenance site.

Note: An output record may be created if the enter key is pressed.

Do you want to test the enter function even though you may create an output record?

Yes No
| Press clear key twice.
| Go to 2

Press enter key.

2 Does display= Time of Day ?

Yes No
| Take entry station and value read module to the Central Facilities Maintenance site.

3 Set the toggle switches on the data wrap plug and the control wrap plug as shown in Figure 4-14.

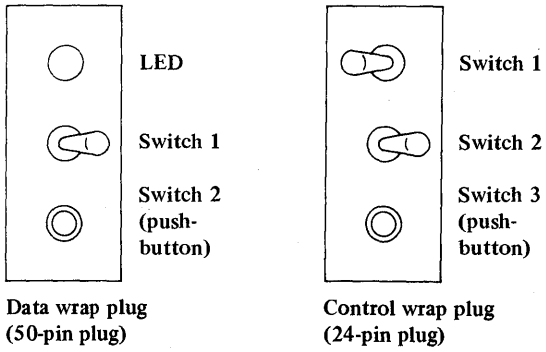


Figure 4-14. Manual mode wrap plugs for test 2

Are all switches positioned as shown in Figure 4-14?

Yes No
| Go to 3

Press action key 1–7 that failed during manual operation.

Does display= X F1 ?

X=action key 1–7

Yes No
| Take entry station and value read module to the Central Facilities Maintenance site.

Press action key 8.

Does display= **7873** ?

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Press enter key. (Key should be disabled and not create an output record.)

Does display= **7873** ?

Yes No

Does display= **Time of Day** ?

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

The enter key test failed and an output record was created. If possible, delete that record from your data output record.

Press clear key twice.

Does display= **Time of Day** ?

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

All tests of the manual mode circuitry have been completed. The problem is not in the 5239 module or the value read attachment in the entry station. The problem is either in the signal cable or external device.

Note: If the enter key function was skipped to avoid creating an output record and the problem being experienced is due to the enter function, take the entry station and value read module to the Central Facilities Maintenance site.

1-of-10B Manual Protected Mode Test

- Install the data wrap plug and the control wrap plug on the value read module as instructed at INST .
- Set the toggle switches on the data wrap plug and the control wrap plug as shown in Figure 4-15.
- Set the entry station mode switch to normal mode.

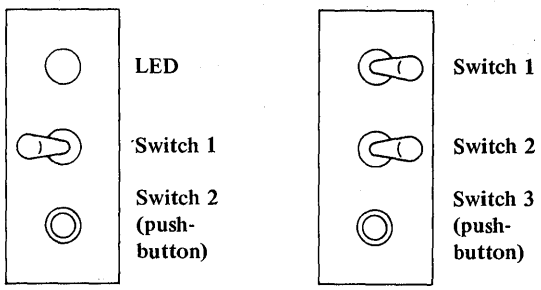


Figure 4-15. Manual protected mode wrap plugs

Are all switches positioned as shown in Figure 4-15?

Yes No
- No: Go to 1-of-10B

Press action key 7.

Does display= 7 F1 **?**

Yes No
- No: Take entry station and value read module to the Central Facilities Maintenance site.

Press numeric keys 1 through 0.

Does display= 7 F1 **?**

Yes No
- No: Take entry station and value read module to the Central Facilities Maintenance site.

Press action key 8.

Does display= 78735690 **?**

Yes No
- No: Take entry station and value read module to the Central Facilities Maintenance site.

Note: An output record may be created if the enter key is pressed.

Do you want to test the enter function even though you may create an output record?

Yes No
- No: Press clear key twice.

  Does display= Time of Day **?**

  Yes No
  - No: Take entry station and value read module to the Central Facilities Maintenance site.

  Go to 4

Press enter key.

4 Do you have a second field (F2) personalized?

Yes No
- No: Go to 5

Does display= 7 F2 **?**

Yes No
- No: Take entry station and value read module to the Central Facilities Maintenance site.

Press numeric keys 1 through 5.

Does display= 12345 **?**

Yes No
- No: Take entry station and value read module to the Central Facilities Maintenance site.

Press clear key.

Does display= 7 F2 **?**

Yes No
- No: Take entry station and value read module to the Central Facilities Maintenance site.

Press numeric keys 6 through 0.

Does display= 67890 **?**

Yes No
- No: Take entry station and value read module to the Central Facilities Maintenance site.

Note: An output record may be created if the enter key is pressed.

Do you want to test the enter function even though you may create an output record?

Yes No

Press clear key twice.

Does display= Time of Day ?

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Go to 6

Press enter key.

5 Does display= Time of Day ?

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

6 All tests of the manual protected mode circuitry have been completed. The problem is not in the value read attachment or in the module. The problem is either in the signal cable or external device.

Note: If the enter key function was skipped to avoid creating an output record and the problem being experienced is due to the enter function, take the entry station and value read module to the Central Facilities Maintenance site.

1-of-10C Semiautomatic and Automatic Mode Tests

- Install the data wrap plug and control wrap plug on the value read module as instructed at INST .
- Set the toggle switch on the data wrap plug as shown in Figure 4-16.
- Set the entry station mode switch to normal mode.

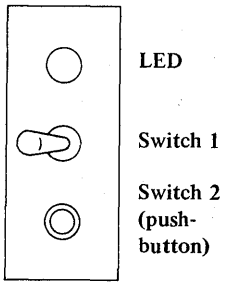


Figure 4-16. Data wrap plug switch positions for semiautomatic and automatic mode test

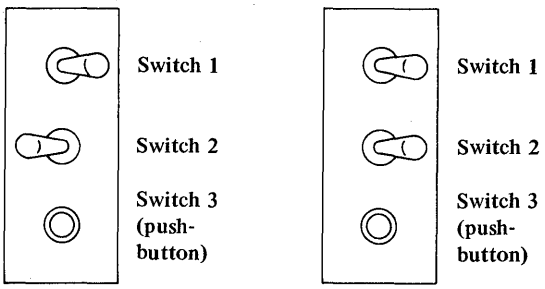


Figure 4-17. Control wrap plug switch positions for selecting action 7 or action 8 for semiautomatic and automatic mode tests

Is action 7 personalized for field 1 (F1)?

Yes No

Set toggle switches on the control wrap plug for action 8 as shown in Figure 4-17.

Set toggle switches on the control wrap plug for action 7 as shown in Figure 4-17.

Note: An output record may be created if the enter key is pressed.

Do you want to test the semiautomatic mode of operation even though you may create an output record?

Yes No

Take the value read module and entry station to the Central Facilities Maintenance site.

Press and hold switch 2 (pushbutton) on the data wrap plug.

Does display= X F1 ?

X=7 or 8 (action personalized)

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

7 Release data wrap plug switch 2 (pushbutton).

Do you have a second field (F2) personalized?

Yes No

Did digits flash across display before displaying Time of Day ?

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Does display= Time of Day ?

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Go to 8

Did digits flash across display before displaying X F2 ?

X=7 or 8 (action personalized)

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Press numeric keys 6 through 0.

Note: An output record may be created if the enter key is pressed.

Do you want to test the enter function and create an output record?

Yes No

Press clear key twice.

Does display= [**Time of Day**] **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Go to **8**

Press enter key.

Does display= [**Time of Day**] **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

8 Press and hold switch 3 on the control wrap plug.

Does display= [**X F1**] **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Release switch 3 on the control wrap plug.

9 Do you have a second field (F2) personalized?

Yes No

Did digits flash across display before displaying [**Time of Day**] **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Does display= [**Time of Day**] **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Go to **11**

10 Did digits flash across display before displaying [**X F2**] **?**

X=7 or 8 (action personalized)

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Press numeric keys 1 through 5.

Does display= [**12345**] **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

Press enter key.

Does display= [**Time of Day**] **?**

Yes No

Take entry station and value read module to the Central Facilities Maintenance site.

11 All tests of the semiautomatic and automatic circuitry have been completed. The problem is not in the value read module or the value read attachment. The problem is either in the signal cable or in the external device.

Note: If the enter key function was skipped to avoid creating an output record and the problem being experienced is due to the enter function, take the entry station and value read module to the Central Facilities Maintenance site.

Training Entry Station Operators

This section describes how to operate an entry station. Training the operators, however, involves more than teaching them how to insert a card or press a key. The operator is not as interested in how the entry station works as in quickly entering the necessary data. A training program should answer the following questions for the operator:

- What is an entry station?
- What actions are to be recorded?
- What entries are necessary to record each action?
- How is data entered?
- How is a problem recognized when recording an action?
- What steps should be taken when a problem is recognized?

Remember, people learn best by doing. When training operators, give them plenty of opportunity to practice recording actions at the entry stations.

What is an Entry Station?

Introduce the operator to the entry stations. Emphasize the parts of the entry station that are important to the operator:

- The power switch
- The display
- The status indicators
- The action keys
- The action key card
- The card reader (if used)
- The card indicators
- The badge reader (if used)
- The badge indicators
- The numeric keys
- The mode switch

When the operator can recognize each of these parts, this step of your training program is completed.

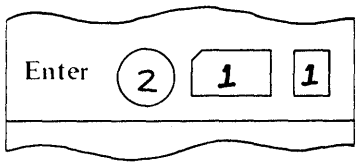
What Actions are to be Recorded?

The answer to this question depends on your requirements. You may require one operator to record certain actions, such as receiving or disbursing material, and another operator to record other actions, such as completing or moving parts. List the actions you require each operator to enter; to avoid confusion later, list them in the same order they appear on the entry station each operator will use, and use the terms that appear on the action key cards.

Of course, for a time entry station, there is only one possible action. When every operator understands the meaning of each action that appears on an entry station, this step of your training program is completed.

What Entries are Necessary to Record Each Action?

List the entries (card, badge, and key) that the operator must perform to complete each action. The action key cards, shown in Appendix C, have symbols to help remind the operator of the entries necessary for each action. If an action requires one card, one badge, and two key entries, note this on the action key card as shown here.



When you have more than one card entry for an action, the cards must be entered in the proper sequence; the same is true when you have more than one key entry for an operation. When every operator understands the entries that must be made for each action, and the order in which they must be entered, this step of your training program is completed.

How is Data Entered?

This step of your training program is completed when every operator understands how to:

- Enter data by card, badge, key, or value read entry
- Recognize that the data has been accepted
- Correct data that is entered erroneously

How is a Problem Recognized When Recording an Action?

The operator must know how:

- The entry station should appear before an action is entered
- The entry station should appear after pressing an action key
- The entry station indicates that it accepted an entry
- The entry station indicates that the action is completed

When every operator can recognize each of these conditions, this step of your training program is completed.

How the Entry Station Should Appear Before an Action is Entered

You should train your operator to recognize this appearance, which should always be the same when the entry station is ready to receive an action. It is simple to recognize. For the data entry station, the time of day is displayed and the green status indicator is on. When only time of attendance entries are being made, the yellow status indicator is on and the green insert indicator beside the badge reader is also on. Any other appearance indicates a problem.

For the time entry station, there is no status indicator. Only the green insert indicator beside the badge reader is on to indicate the ready condition.

How the Data Entry Station Should Appear After Pressing an Action Key

This appearance varies, depending on the entries required for the action. The basic rules to follow are:

- The number of the action key appears in the leftmost position of the display.
- The yellow status indicator is on.
- The green insert indicator beside the badge reader comes on if badge entry is required.
- The green insert indicator beside the card reader comes on if card entry is required.
- The time of day disappears and F1 appears in the display if a key entry or value read entry is required.

When you indicate the required entries on the action key card, the operator can easily determine which indicators should be on.

How the Entry Station Indicates that it Accepted an Entry

The entry station indicates it accepted an entry by the following:

- For card entry, the green insert indicator turns off; if a second card is required, the insert indicator turns on again.
- For badge entry, the green insert indicator turns off; if another badge is to be entered, the insert indicator turns on again.
- For key entry, the number entered appears in the display; if this number is correct, press the enter key. If a second key entry is required, an F2 appears in the display. Repeat this procedure for the second key entry. If a third key entry is required, an F3 appears in the display. The time of day appears when no other key entry is required.
- For value read entry, the external value appears in the display. If this number is correct, press the enter key. If a second field is required, an F2 appears in the entry station display. A manual value read or a key entry can be entered into this field. Following the entry of field 2 (F2), if a third field is required, an F3 appears in the display. The same type of input may be used for field 3 (F3) as for field 2 (F2). The time of day appears when no other input data is required.

How the Entry Station Indicates that the Action is Completed

The entry station returns to the ready condition when the operator satisfactorily enters the required card, badge, key, or value read data. The appearance of the entry station is the same as it was before the action was entered. The action is not recorded until the entry station returns to the ready condition. Be sure to emphasize that the operator *must not leave* the entry station before it returns to the ready condition.

What Steps Should be Taken When a Problem is Recognized?

The entry station operator normally tries to correct only those problems caused by incorrect entry. In all other cases, the supervisor or person responsible for system operation should be be called. The majority of operator errors, and their corrective actions, are:

- Key entry error; wrong number appears in display. To correct, press the clear key to clear the display; reenter the number.
- Action partially entered; operator realizes he pressed the wrong action key. To correct, press the proper action key.
- Red data check indicator comes on beside badge reader or card reader after a badge or card is inserted. The card or badge does not have the proper character in the check position; use the correct card or badge.
- For other conditions that prevent proper entry, retry the entry. If this retry is unsuccessful, record the action by means of the backup procedure and call the supervisor.

When every entry operator can follow this error-correction procedure, the training program is completed.

Appendix A. Personalization

Transaction Definition Records

All transaction definition records are passed to the attachment by the Series/1 via a configurate operation.

The following formats are used:

- System configuration
- Transaction definition
- Transaction checking definition

System Configuration Format

Byte	Limits	Meaning
1	1	Record type (must be 1)
2	1–9, A–Z	Loop 1 ID
3	Blank, 0–7	ES ID (see Note)
4	Blank, 0–7	ES ID
5	Blank, 0–7	ES ID
6	Blank, 0–7	ES ID
7	Blank	
8	Blank, 1–9, A–Z	Loop 2 ID
9	Blank, 1–7	ES ID
10	Blank, 1–7	ES ID
11	Blank, 1–7	ES ID
12	Blank, 1–7	ES ID
13	Blank	
14	Blank, 1–9, A–Z	Loop 3 ID
15	Blank, 1–7	ES ID
16	Blank, 1–7	ES ID
17	Blank, 1–7	ES ID
18	Blank, 1–7	ES ID
19	Blank	
20	Blank, 1–9, A–Z	Loop 4 ID
21	Blank, 1–7	ES ID
22	Blank, 1–7	ES ID
23	Blank, 1–7	ES ID
24	Blank, 1–7	ES ID

Note: The entry station IDs must agree with the address selected at the entry station. The same digit must not be repeated within one multiplexer. One entry station ID of 0 must be specified on the first loop for Central Facilities Maintenance.

Transaction Definition Format

Byte	Limits	Meaning
1	4	Record type (must be 4)
2	(1–9) (A–Z)	Loop ID
3	1–7	ES ID
4	Blank	
5	Y,N	*Key 1* active? Y=yes,N=no
6	Y,N	Supervisor required? Y=yes,N=no
7	Y,N	Time and attendance? Y=yes,N=no
8	0,1,2–8	Number of badges/packing factor
9	0,1,2,3	Number of key fields
10	0,1,2	Number of cards
11	Blank	
12	Y,N	*Key 2* active? Y=yes,N=no
13	Y,N	Supervisor required? Y=yes,N=no
14	Y,N	Time and attendance? Y=yes,N=no
15	0,1,2–8	Number of badges/packing factor
16	0,1,2,3	Number of key fields
17	0,1,2	Number of cards
18	Blank	
19	Y,N	*Key 3* active? Y=yes,N=no
20	Y,N	Supervisor required? Y=yes,N=no
21	Y,N	Time and attendance? Y=yes,N=no
22	0,1,2–8	Number of badges/packing factor
23	0,1,2,3	Number of key fields
24	0,1,2	Number of cards
25	Blank	
26	Y,N	*Key 4* active? Y=yes,N=no
27	Y,N	Supervisor required? Y=yes,N=no
28	Y,N	Time and attendance? Y=yes,N=no
29	0,1,2–8	Number of badges/packing factor
30	0,1,2,3	Number of key fields
31	0,1,2	Number of cards
32	Blank	
33	Y,N	*Key 5* active? Y=yes,N=no
34	Y,N	Supervisor required? Y=yes,N=no
35	Y,N	Time and attendance? Y=yes,N=no
36	0,1,2–8	Number of badges/packing factor
37	0,1,2,3	Number of key fields
38	0,1,2	Number of cards

39	Blank	
40	Y,N	*Key 6* active? Y=yes,N=no
41	Y,N	Supervisor required? Y=yes,N=no
42	Y,N	Time and attendance? Y=yes,N=no
43	0,1,2–8	Number of badges/packing factor
44	0,1,2,3	Number of key fields
45	0,1,2	Number of cards
46	Blank	
47	Y,N	*Key 7* active? Y=yes,N=no
48	Y,N	Supervisor required? Y=yes,N=no
49	Y,N	Time and attendance? Y=yes,N=no
50	0,1,2–8	Number of badges/packing factor
51	0,1,2,3	Number of key fields
52	0,1,2	Number of cards
53	Blank	
54	Y,N	*Key 8* active? Y=yes,N=no
55	Y,N	Supervisor required? Y=yes,N=no
56	Y,N	Time and attendance? Y=yes,N=no
57	0,1,2–8	Number of badges/packing factor
58	0,1,2,3	Number of key fields
59	0,1,2	Number of cards

Note: If the key active field is coded N, the next five fields can be coded as blanks.

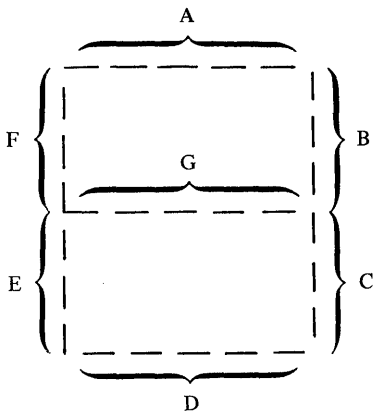
Transaction Checking Definition Format

Byte	Limits	Meaning
1	5	Record type (must be 5)
2	(1–9)(A–Z)	Loop ID
3	1–7	ES ID
4	Blank	
5–6		*Key 1*—Card check column
7		First card check character
8		Second card check character
9–10		Badge check column
11		First badge check character
12		Second badge check character
13	Blank	
14–15		*Key 2*—Card check column
16		First card check character
17		Second card check character
18–19		Badge check column
20		First badge check character
21		Second badge check character
22	Blank	
23–24		*Key 3*—Card check column
25		First card check character
26		Second card check character
27–28		Badge check column
29		First badge check character
30		Second badge check character
31	Blank	
32–33		*Key 4*—Card check column
34		First card check character
35		Second card check character
36–37		Badge check column
38		First badge check character
39		Second badge check character
40	Blank	
41–42		*Key 5*—Card check column
43		First card check character
44		Second card check character
45–46		Badge check column
47		First badge check character
48		Second badge check character

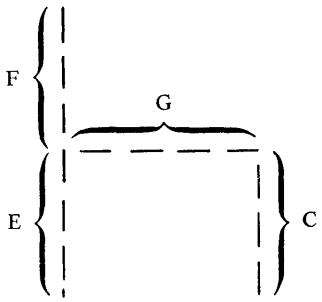
49	Blank	
50–51		*Key 6*—Card check column
52		First card check character
53		Second card check character
54–55		Badge check column
56		First badge check character
57		Second badge check character
58	Blank	
59–60		*Key 7*—Card check column
61		First card check character
62		Second card check character
63–64		Badge check column
65		First badge check character
66		Second badge check character
67	Blank	
68–69		*Key 8*—Card check column
70		First card check character
71		Second card check character
72–73		Badge check column
74		First badge check character
75		Second badge check character

Appendix B. Data Message Format

This appendix should assist you in preparing characters for display. This diagram shows the various segment identifications that you code to obtain the desired characters:



For example, if you want a lowercase h, code segments C, E, F, and G. You will obtain the following:



Refer to this chart to determine the various combinations that make up the available characters.

Character	Segment code								Hexadecimal
	A	B	C	D	E	F	G	0	
Space	0	0	0	0	0	0	0	0	00
0	1	1	1	1	1	1	0	0	FC
1	0	1	1	0	0	0	0	0	60
2	1	1	0	1	1	0	1	0	DA
3	1	1	1	1	0	0	1	0	F2
4	0	1	1	0	0	1	1	0	66
5	1	0	1	1	0	1	1	0	B6
6	1	0	1	1	1	1	1	0	BE
7	1	1	1	0	0	0	0	0	E0
8	1	1	1	1	1	1	1	0	FE
9	1	1	1	1	0	1	1	0	F6
A	1	1	1	0	1	1	1	0	EE
C	1	0	0	1	1	1	0	0	9C
E	1	0	0	1	1	1	1	0	9E
F	1	0	0	0	1	1	1	0	8E
H	0	1	1	0	1	1	1	0	6E
J	0	1	1	1	1	0	0	0	78
L	0	0	0	1	1	1	0	0	1C
P	1	1	0	0	1	1	1	0	CE
U	0	1	1	1	1	1	0	0	7C
b	0	0	1	1	1	1	1	0	3E
c	0	0	0	1	1	0	1	0	1A
d	0	1	1	1	1	0	1	0	7A
h	0	0	1	0	1	1	1	0	2E
i	0	0	1	0	0	0	0	0	20
n	0	0	1	0	1	0	1	0	2A
o	0	0	1	1	1	0	1	0	3A
r	0	0	0	0	1	0	1	0	0A
u	0	0	1	1	1	0	0	0	38

Appendix C. Supplies

Your IBM Series/1 Data Collection Interactive system requires supplies that may be ordered through your IBM Information Records Division (IRD) sales representative or General Systems Division (GSD) sales representative.

Cards

Your entry stations may require either 96- or 80-column cards, which can be printed with a general purpose format, or they can be custom-designed to enhance your particular applications. The general purpose 96-column card is the IBM 3700 card; the general purpose 80-column card is the IBM 5081 card.

Specific preprinted shop cards are available from IRD for data processing support of the Series/1 Data Collection Interactive. Your GSD representative has samples of these cards. Each type of card may be individually ordered. See Figures C-1 and C-2.

	IBM part number	
Type card	**80-column**	**96-column**
Order/material receipt	W41071	W41067
Material issue	W41072	W41068
Move	W41073	W41069
Operation	W41074	W41070

All cards used for entering data at the data entry stations should have an imprinted arrow, which is used to assist the operator in correct card insertion.

For assistance in design and ordering of special feature cards, contact your IBM IRD sales representative.

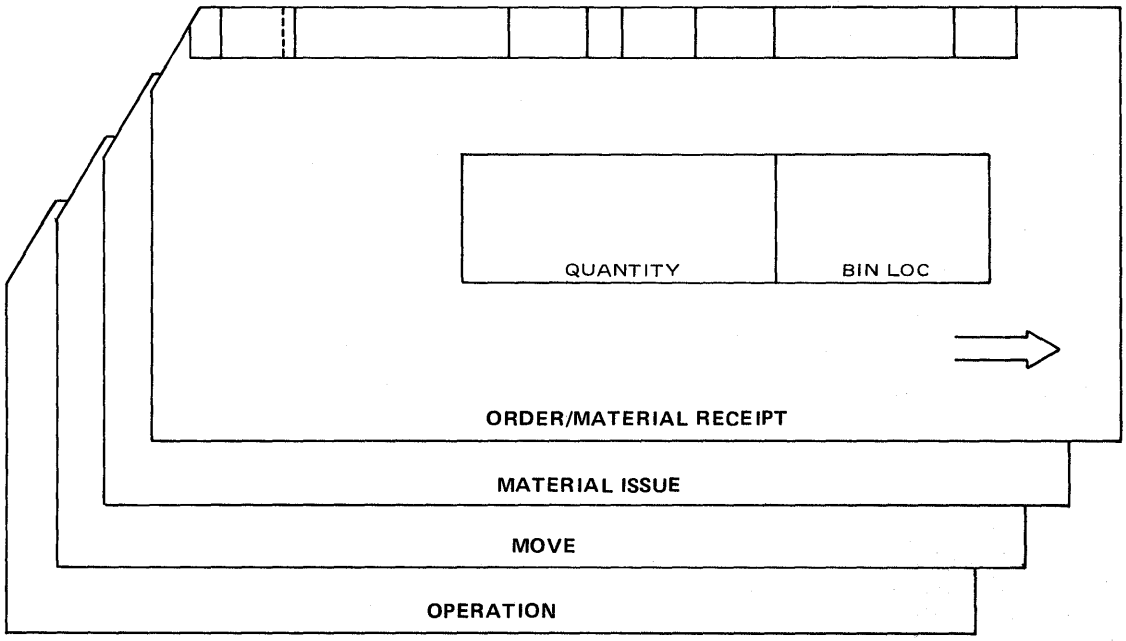


Figure C-1. Preprinted 80-column cards

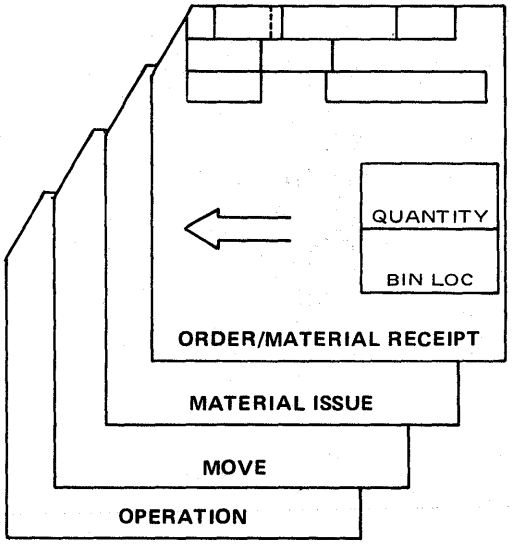


Figure C-2. Preprinted 96-column cards

Badges

Magnetic stripe badges and punched hole badges used with the Series/1 Data Collection Interactive attachment feature must meet the specifications as stated in *IBM 5230 Data Collection System Badge Specifications*, GA21-9259. This document is available through the IBM publication distribution centers. Standard hole badges (IBM part number 2461900) or magnetic badges (IBM part number 2461901), shown in Figure C-3, contain the following:

- Registration guide hole (punched badge only)
- Clip hole
- Basic printing on badge front
- Punching or encoding of numeric data
- Printing of the first seven digits on the badge front for visual identification
- Signature panel on back

Standard Series/1 badges conform to the specifications as stated in *IBM 357/1030/2790 Badge Specifications*, GA34-9028. In addition, the punched hole badges must have the registration guide hole and must be opaque, except for a 4-mm border along the 9-edge and a 3-mm border along all other edges. These borders may be either opaque or transparent. The dimensions of these badges are approximately 60 mm (2.4 in) by 85 mm (3.3 in) by 1 mm (0.04 in).

For special requirements, contact your IBM IRD sales representative.

Samples of each type badge are available through the IBM publication distribution centers. The order numbers are:

Hole badge (punched) GX60-0016
Magnetic badge (encoded) GX60-0017

Contact your IBM GSD sales representative for samples.

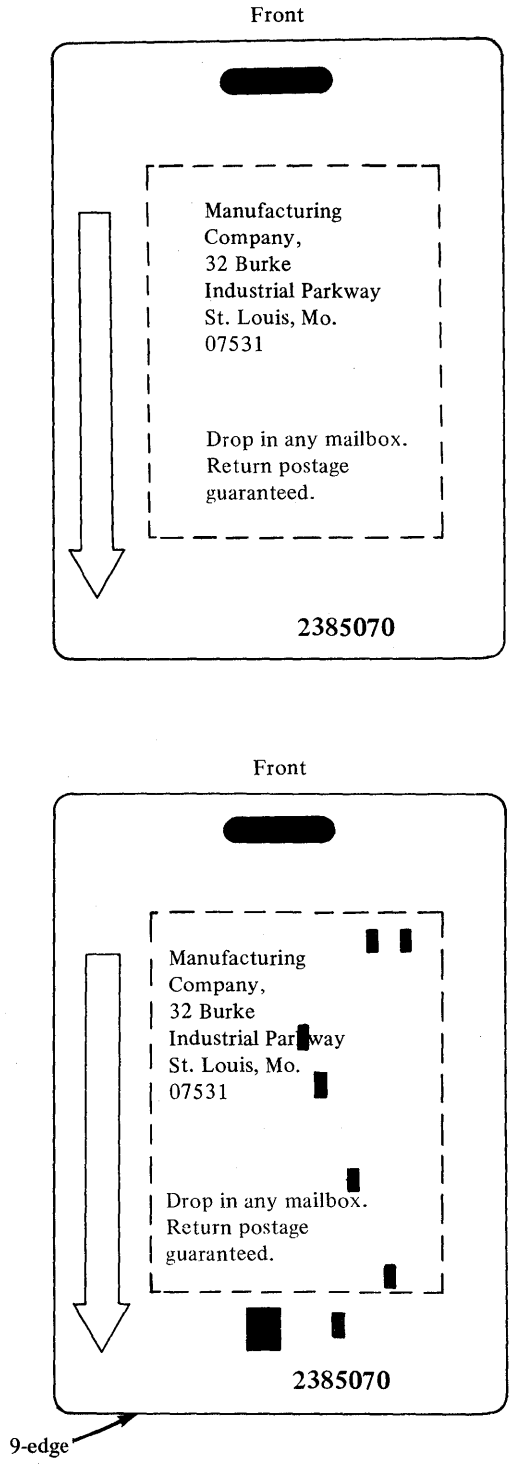


Figure C-3. Badges

Badge Layout Specifications

The standard badge layout for the magnetic and hole badges used with the IBM Series/1 Data Collection Interactive attachment feature is shown in Figure C-4.

The parts of the badges are numbered as follows:

1. Standard clip hole. The clip for fastening badge to apparel is optional, and comes unattached to the badge.
2. The arrow printed on each badge, showing the proper direction for insertion into the badge reader.
3. The area within the dotted line, approximately 38 mm (1.5 in) x 50 mm (2.0 in), is available for hot-stamp printing in block letters of any information you desire. Include typewritten copy of the information that you desire to have printed. Your copy will be reduced in size, if necessary, to fit within the badge print area. For optimum legibility, medium-to-large size block lettering is recommended for printing information, such as company name, address, return instructions, etc. Note that some of the printed information may be punched through in hole badges. Company logos and artwork are difficult to hot-stamp print and should not be used. Artwork, when used, requires special handling and longer delivery schedules than for standard badges.

   Note: Only the information you submit in typewritten form or artwork will be printed; Be sure and include everything you want printed.
4. Seven-digit badge number printed on the badge front. This number is always the first seven digits punched or coded in the badge. (These first seven digits are called the badge number. The first two digits of each badge set are always the same; the next five digits provide the sequence number of the badge within the set.) Note that even though only the first seven digits are printed on the badge front, the actual punched or encoded information within each badge may exceed seven digits.
5. Total information punched into a hole badge (10 digits, maximum) or encoded on a magnetic badge (17 digits, maximum).
6. Signature panel for employee signature verification.
7. Registration guide hole (hole badges only) for proper registration within the hole badge reader. This hole may be round or square.

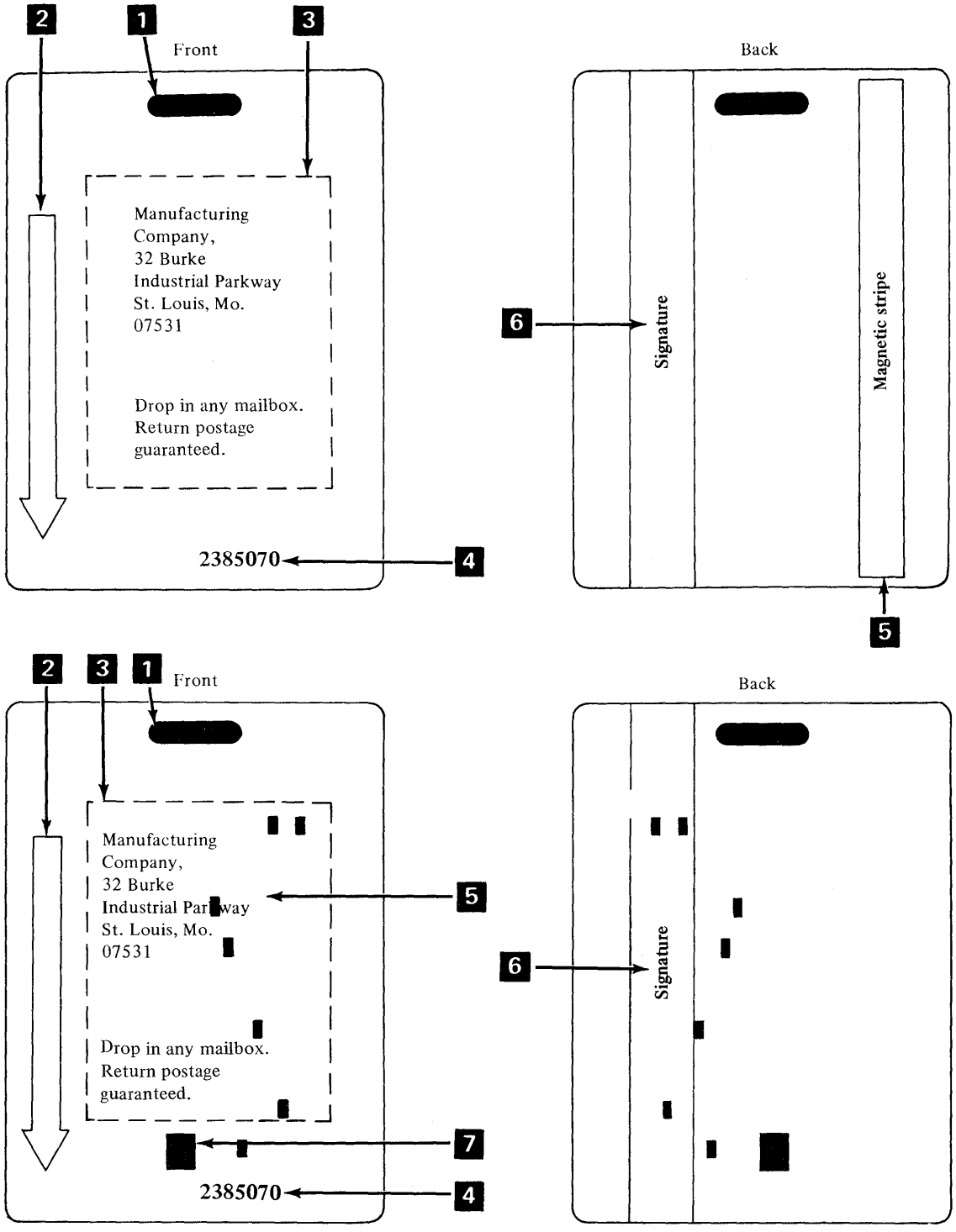


Figure C-4. Badge specifications

Appendix D. Forms

Schedule of events

Week	Actual schedule dates	Responsibility		Date complete	Event
		Customer	IBM		
12	_____	X		_____	• Identify specific customer project leader responsible for all phases of the Series/1 Data Collection Interactive installation schedule.
		X		_____	• Decide who will physically install the loop wiring, value read wiring, station connectors, loop connectors, station mounting brackets, value read module mounting brackets, and ac power (maintenance personnel or contractor).
		X	X	_____	• Fill in "actual schedule dates" on this form and give copy to IBM representative.
				_____	• Identify value read requirements (if applicable). Contact supplier of external devices (scales, counters, etc.). External devices ordered as required.
		X		_____	• Identify and schedule data communications needs. Source for data link identified (telephone company contacted). Modems ordered as required.
		X		_____	• Finalize floor plan layout using the plan views in Chapter 3. Show location of Series/1, all entry stations, value read modules, and wiring.
		X		_____	• Confirm sufficient quantities of accessories are ordered.
11	_____	X	X	_____	• Contact by IBM representative resulting in joint agreement in overall installation plan.
10	_____	X		_____	• Place order for supplies listed in Appendix C.
9		X		_____	• Release purchase order or work order for physical installation of mounting brackets, station connectors, loop cabling, and ac power.
		X		_____	• Define training program for employees and supervisors.
7		X	X	_____	• Review Installation Plan to define any exposures to schedule.
		X	X	_____	• Confirm on-site arrival of IBM accessory package containing station connectors, mounting brackets, cables, etc.
		X		_____	• Start installation of mounting brackets, cabling, and power receptacles.

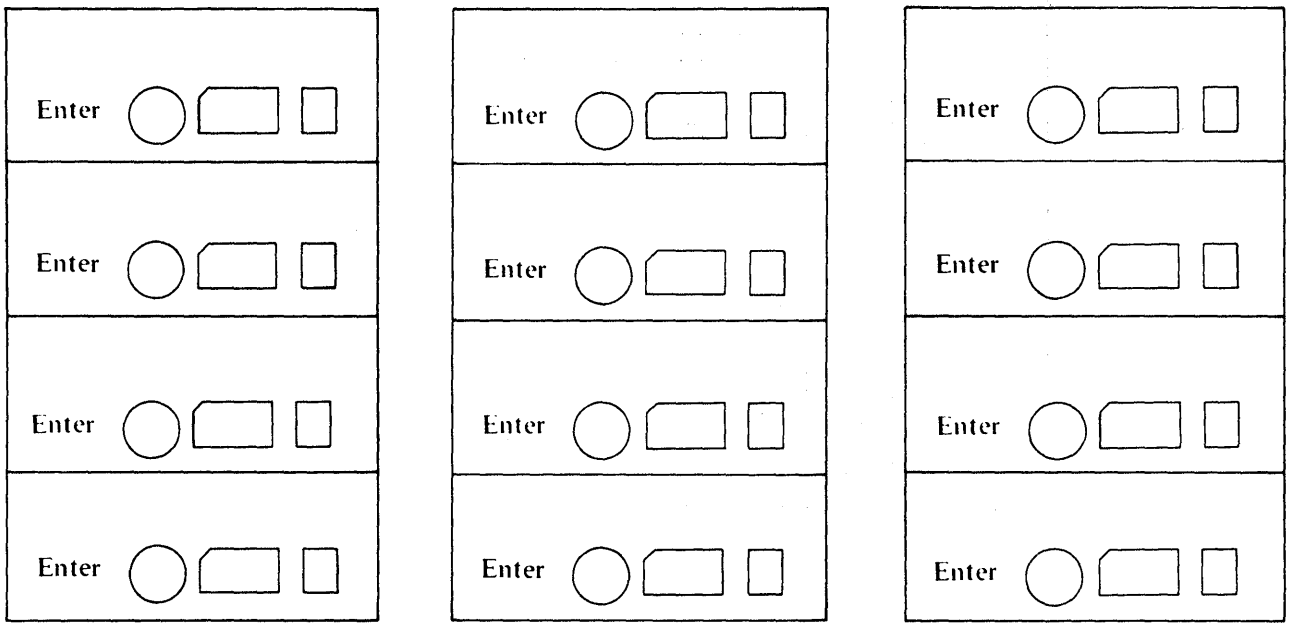
Schedule of events (continued)

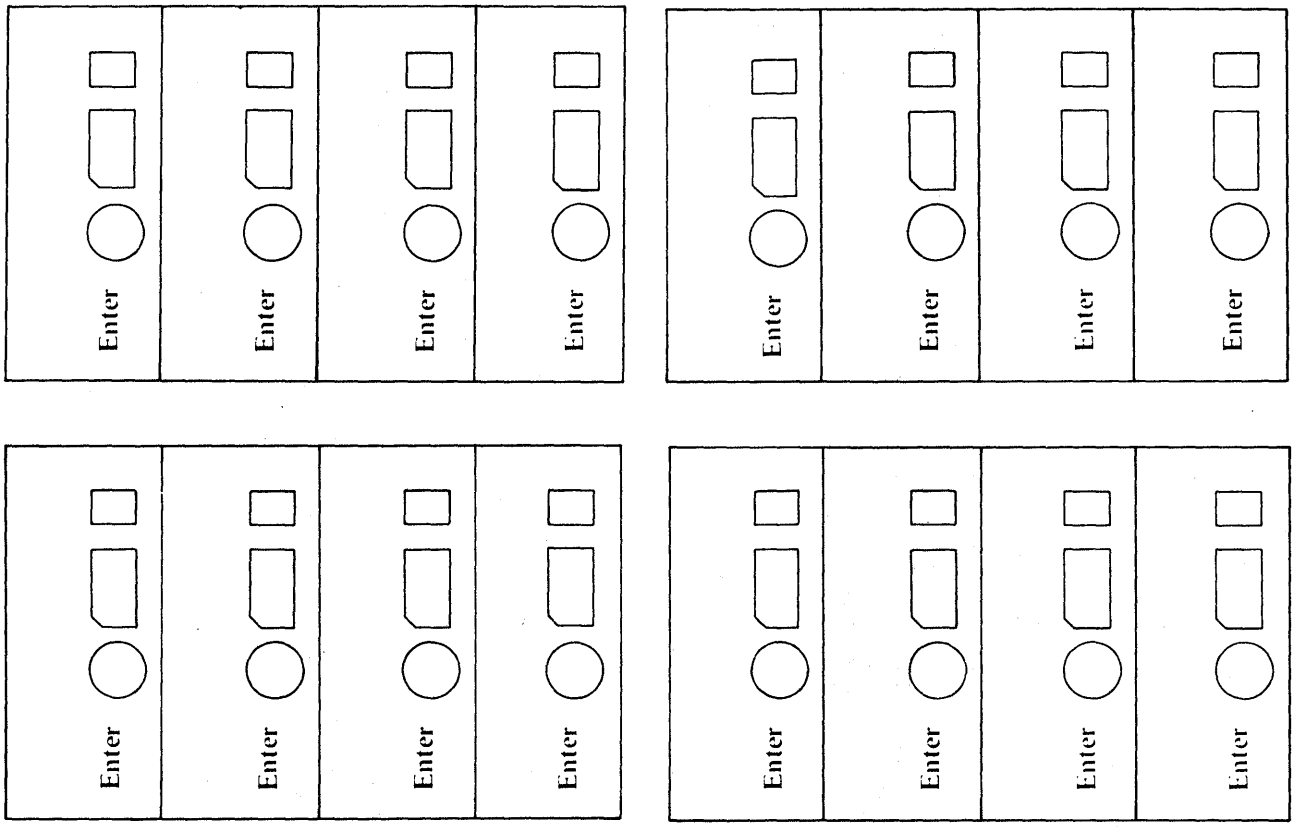
Week	Actual schedule dates	Responsibility		Date complete	Event
		Customer	IBM		
5	_____	X		_____	• Begin supervisor training.
			X	_____	• Contact by IBM sales representative to check progress of physical installation.
4	_____	X		_____	• Prepare entry station action cards
		X		_____	• Define employee instruction procedures.
		X		_____	• Supplies (cards, badges, etc.) received.
3	_____	X		_____	• Complete physical installation of mounting brackets, value read external device, dabling, power receptacles, and station connectors.
2	_____	X		_____	• Complete checkout of physical installation, i.e., continuity and polarity tests of loop interconnections, physical checks of mounting brackets, power receptacles, safety considerations, external alarm, etc.
		X		_____	• Physical installation complete.
1	_____		X	_____	• Series/1, entry stations, associated equipment arrive on site.
		X		_____	• Series/1 Data Collection Interactive hardware moved to locations. Entry stations and value read modules hung on brackets, plugged in to power receptacles and station connectors.
0		X	X	_____	• IBM Customer Engineer on site, powers up and checks out Series/1. Plugs in loop connectors.
		X	X	_____	• System turned over to customer.
		X		_____	• Check out entry station operation.
		X		_____	• Supervisor employee training sessions held.

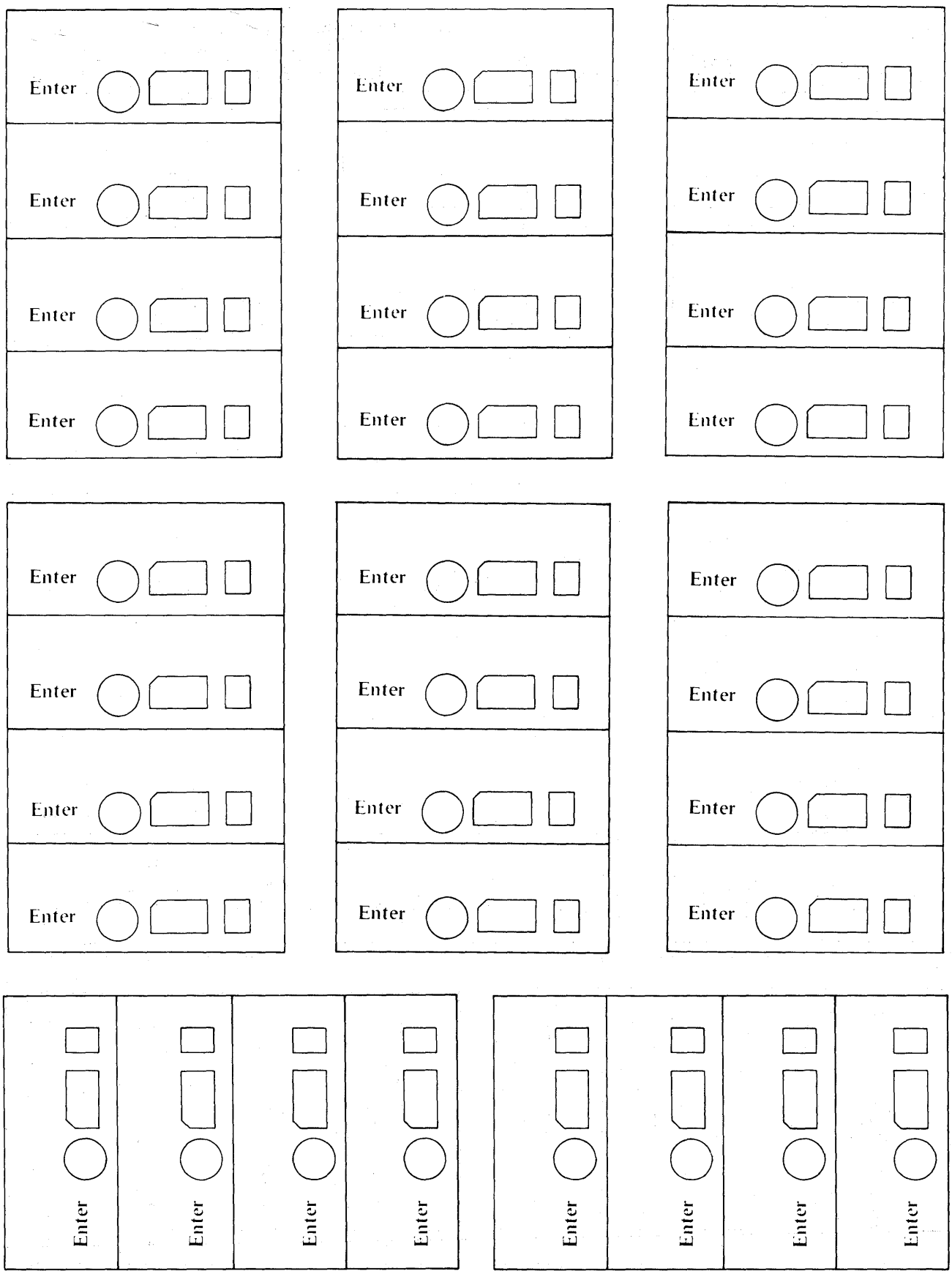
Action Cards

Type or write on action cards the action for each key of each entry station.

Mark the number of entries required for each action. Place the completed action card in the pocket provided for it on the entry station.



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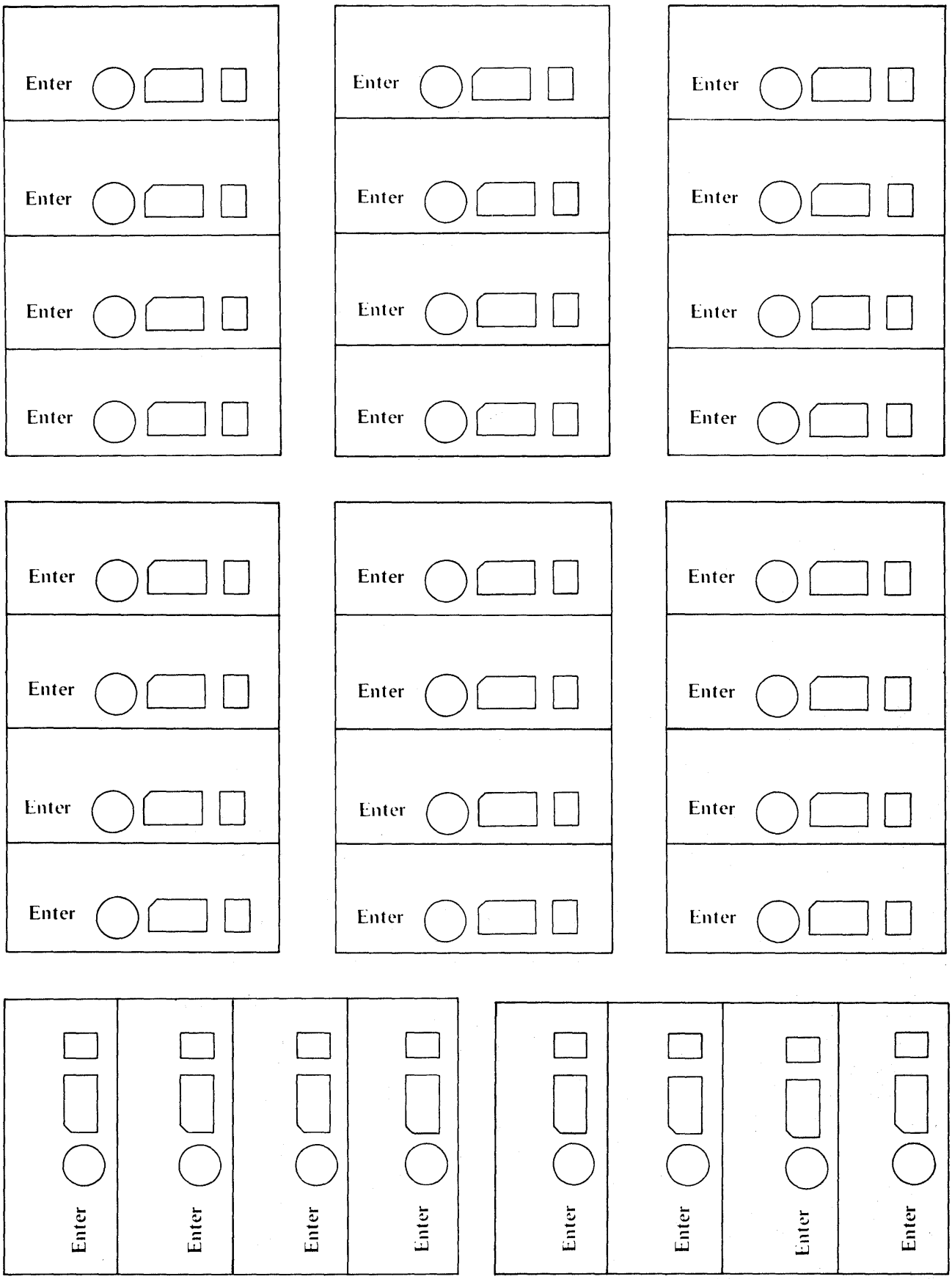
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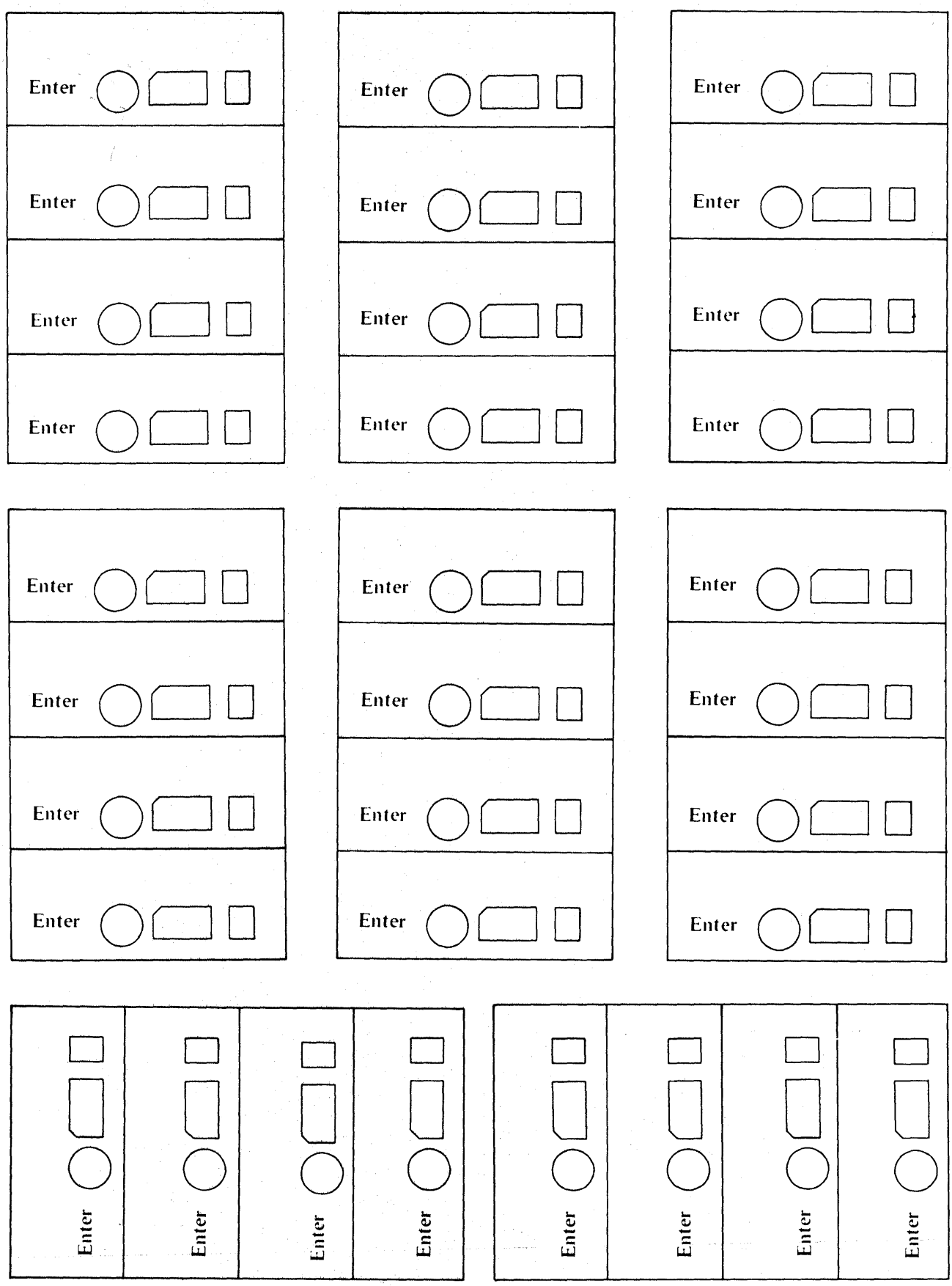
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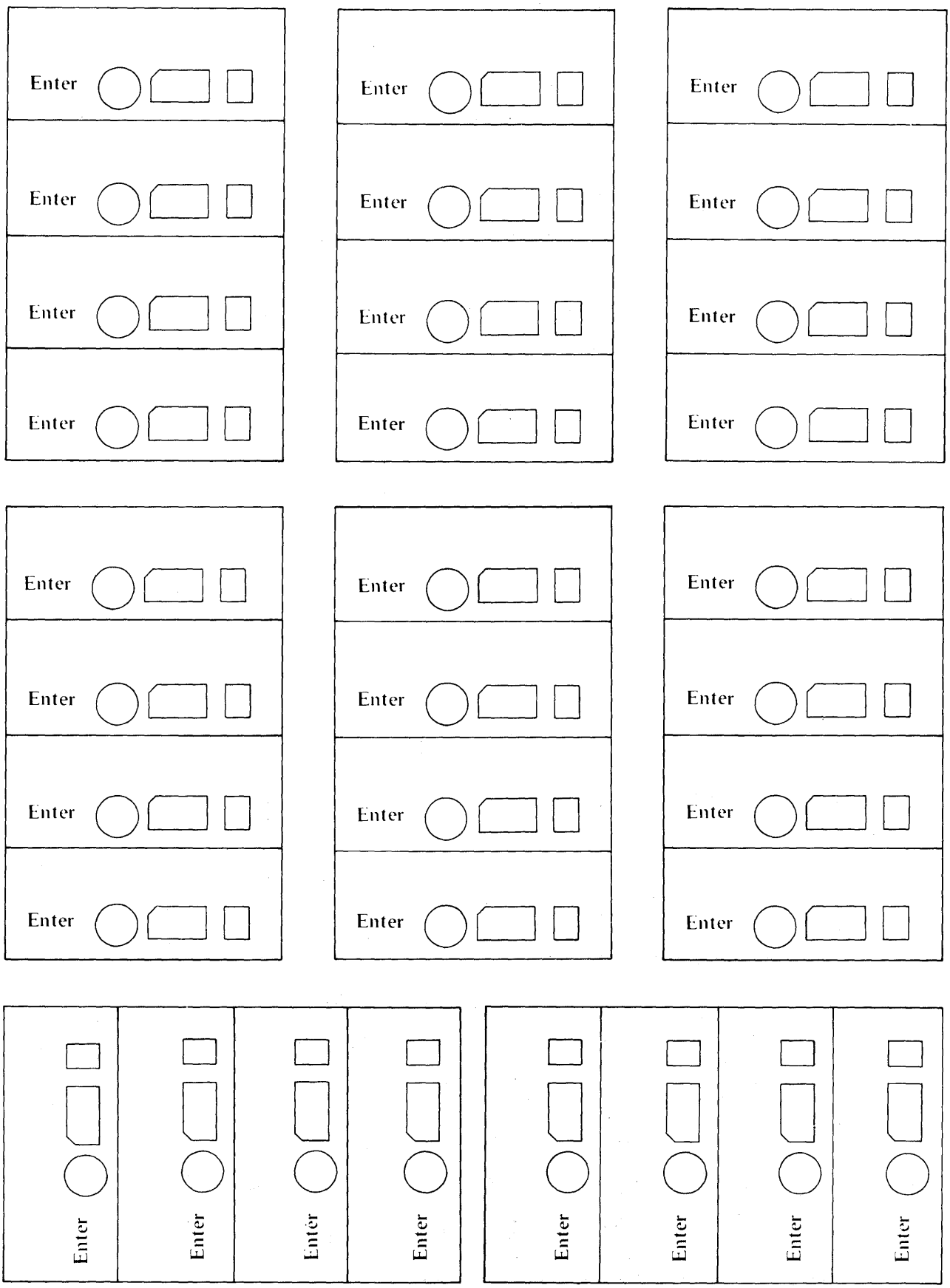
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Appendix E. Control Diskette

An IBM diskette is supplied with each RPQ D02312. The data on this diskette must be loaded into the RPQ D02312 scheduler and the RPQ D02314 scheduler, if installed, everytime the Series/1 is powered down and then powered up again.

Program RPQ P82600, if installed, contains the instructions necessary to make this diskette data part of your IPL program after an initial installation procedure.

If RPQ P82600 is not installed, retrieve the data from the RPQ D02312/14 control diskette and load it to a data set, which you create on your disk or diskette. This data will become part of your initial program load (IPL). (Data transfer from the control diskette to your data set is required only once). The data of this data set must be written to the RPQ D02312/14 scheduler(s) during the first IPL after power up.

On every subsequent IPL, perform a check to ensure that the control data has been previously loaded to the RPQ D02313/14 scheduler(s). This is done by reading two bytes from random access memory locations '08FE' and '08FF'. If both locations are 0's, write the control data from your data set to the RPQ D02312/14 scheduler(s). See the DCB information in this section (Second Read Transfer Test Pattern command) for the command used to perform this check.

An attempt to write the control data to the scheduler(s) when locations '08FE' or '08FF' are not 0's results in an exception interrupt with specification check (bit 3) set in the ISB.

The RPQ D02312/14 control diskette is a basic exchange format diskette with 128-byte records. There are three header records on cylinder 0, sectors 8, 9, and 10, that point to three identical copies of data: RAMDATA1, RAMDATA2, and RAMDATA3, respectively. Each copy is 256 bytes long. Refer to the *IBM Series/1 4962 Disk Storage Unit and 4964 Diskette Unit Description*, GA34-0024, for the necessary disk or diskette I/O commands.

Contents	From		To		Length (bytes)
	Track	Sector	Track	Sector	
HDR1 RAMDATA1	00	008	N/A	N/A	128
HDR1 RAMDATA2	00	009	N/A	N/A	128
HDR1 RAMDATA3	00	010	N/A	N/A	128
RAMDATA1	(See Note)	(See Note)	(See Note)	(See Note)	256
RAMDATA2	(See Note)	(See Note)	(See Note)	(See Note)	256
RAMDATA3	(See Note)	(See Note)	(See Note)	(See Note)	256
Note: See header information for data location.					

The commands used for data transfer between Series/1 storage and the RPQ D02312/14 scheduler(s) are Write/Read Transfer Test Pattern commands. The IDCB used for those commands is a standard Start I/O command, as explained in Chapter 2.

For Write/Read Transfer Test Pattern commands to be used successfully as part of the RPQ D02312/14 control diskette data loading procedure, the DCB words must be coded as follows:

First Write Transfer Test Pattern command (write data)

DCB word 0—control word = 0060 (hexadecimal)

DCB word 1—attachment storage address = 0800 (hexadecimal)

DCB word 6—byte count = 00FE (hexadecimal)

DCB word 7—data address that points to the beginning of the diskette data in Series/1 storage

Second Write Transfer Test Pattern command (enable data)

DCB word 0—control word = 0060 (hexadecimal)

DCB word 1—attachment storage address = 08FE (hexadecimal)

DCB word 6—byte count = 0000 (hexadecimal)

DCB word 7—data address that points to the last byte minus 1 of the diskette data in Series/1 storage

First Read Transfer Test Pattern command

DCB word 0—control word = 2060 (hexadecimal)

DCB word 1—attachment storage address = 0800 (hexadecimal)

DCB word 6—byte count = 0100 (hexadecimal)

DCB word 7—data address, in Series/1 storage, that points to the beginning of a read buffer.

Second Read Transfer Test Pattern command (to check locations '08FE' and '08FF'):

DCB word 0—control word = 2060 (hexadecimal)

DCB word 1—attachment storage address = 08FE (hexadecimal)

DCB word 6—byte count = 0002 (hexadecimal)

DCB word 7—Series/1 storage address = XXXX

Note: DCB words not listed in this chart should be set to 0's.

Index

ac power 3-18
accessories, data collection interactive 3-14
accounting 1-1
  action 1-2
  comparison-to-standards 1-1
  cost 1-2
  inventory control 1-2
  pay-for-production 1-1
  work-in-process status 1-1
action
  accounting 1-2
  cards D-3
  ID 1-16, 1-17
  key test 4-8, 4-12
  keys 1-7, 4-2
  selection 1-4
action 7 1-12, 1-15
action 8 1-12, 1-15
actions 1-15, 4-27
addresses 3-25
addressing, I/O 2-1
addressing station connector 3-25
attachment feature, data collection 1-2
attachment feature cards 1-5
  loop multiplexer 1-5
  master scheduler 1-5
audible indicator 1-4, 1-7, 3-6

backup procedures 4-6
badge
  buffer 1-15, 1-17
  buffer format 1-17
  entry 1-4
  layout specifications C-4
  reader 1-7, 1-10, 4-4
  reader test 4-9
  record 1-8, 1-14
  types 1-19
badges, required C-3
basic features 1-6
BCD dry contact input 1-11, 3-10
BCD/TTL parallel input 1-11, 3-10
buffers 1-15
  badge 1-17
  data 1-15

cable, loop 3-11, 3-13
cables
  5234 3-9
  5235 3-6
  5236 3-8
  5239 3-10
card
  entry 1-4, 1-14
  reader 1-7, 4-3
  reader test 4-9
  types 1-19
cards, action D-3
cards, attachment feature 1-5
  loop multiplexer 1-5
  master scheduler 1-5
cards, required C-2
central facilities maintenance 3-4
checking, data 1-18
checking, value read parity 1-18
checklists, planning 3-11
coded display chart 4-13
commands, I/O 2-3
  device reset 2-4
  halt I/O 2-8
  prepare 2-4
  read ID 2-3
  start 2-4
  start cycle steal status 2-8
  start diagnostic 2-7
comparison-to-standards accounting 1-1
condition codes 2-11
configuration, system A-1
contacts closure 1-8, 3-6
  connector 3-14, 3-15, 3-22, 3-26
  feature 1-8
  relay 1-8, 3-26
control diskette E-1
conversion table, signal cable 3-43
cost accounting 1-2
customer-supplied items 3-16
cycle-steal
  operation 2-10
  status words 2-12

data
  buffer 1-15
  buffer format 1-16
  checking 1-18
  collection attachment feature 1-2
  collection basic features 1-6
  collection methods and uses 1-1
  entry station (*see* 5235 Data Entry Station and 5236 Data Entry Station)
  formats, output 1-4
  message format B-1
  record 1-14
day of week 1-16
DCB (*see* device control block)

definition
transaction A-2
transaction checking A-2
delay circuitry 1-8
device control block (DCB) 2-1
DCB word 0-control word 2-2
DCB word 1-device parameter 1 2-2
DCB word 2-device parameter 2 2-2
DCB word 3-device parameter 3 2-2
DCB word 4-device parameter 4 2-3
DCB word 5-device parameter 5 2-3
DCB word 6-byte count 2-3
DCB word 7-data address 2-3
device reset command 2-4
direct program control (DPC) operation 2-9
diskette, control E-1
DPC (direct program control) operation 2-9

electrical interference 3-12
entry stations 1-4
5234 Time Entry Station 1-10
5235 Data Entry Station 1-7
5236 Data Entry Station 1-9
external-device supplier information 3-36
attachment timing chart 3-39
BCD input displayed 3-41
cable connectors 3-40
control cable option selection 3-31
parity checking 3-40
signal cable and control cable signals 3-37
signal functions 3-38
TTL levels 3-38
1-of-10 device wiring 3-32
1-of-10 input displayed 3-42
1-of-10 signal levels 3-32
357, 1030, 2790 attachment 3-43

feature, data collection attachment 1-2
feature cards, attachment 1-5
loop multiplexer 1-5
master scheduler 1-5
features, data collection basic 1-6
floor plan 3-11
format
badge buffer 1-17
data buffer 1-16
formats, output data 1-4
forms, required D-1

halt I/O command 2-8
header 1-16
hole badge 1-19

I/O
addressing 2-1
commands 2-3
device reset 2-4
halt I/O 2-8
prepare 2-4
read ID 2-3
start 2-4
start cycle steal status 2-8
start diagnostic 2-7
IDCB (immediate device control block) 2-1
immediate device control block (IDCB) 2-1
indicator, audible 1-4, 1-7, 3-6
input/output operations 2-1
commands 2-3
resets 2-4
status 2-11
installation
instructions 3-1, 3-18
schedule of events 3-1
instruction, operate I/O 2-1
interrupt ID word 2-11
inventory control accounting 1-2

key 1-16
key entry 1-4, 1-7, 4-2
keyboard test 4-8

loop
assignments 3-11
cable 3-18
cabling 3-11
connector 3-27
ID 1-16, 1-17
multiplexer card 1-5
test 3-28
wire 3-13
loops, data collection interactive 1-13

magnetic badge 1-19
maintenance, central facilities 3-4
master scheduler card 1-5
message format B-1
mode switch 1-7, 1-16, 1-17, 4-5
mounting bracket 3-14, 3-15, 3-21
multiplexer card, loop 1-5

numeric keys 1-7, 4-2

operate I/O instruction 2-1
operating the data entry station 4-1
operations 2-4
  activate buzzer 2-7
  configurate 2-5
  cycle steal 2-10
  direct program control (DPC) 2-9
  read data 2-4
  send/erase message to data entry station 2-7
  send time of day 2-7
  start loop 2-5
  stop loop 2-5
  test loop 2-5
  transfer patterns 2-6
operations, input/output 2-1
  commands 2-3
  resets 2-4
  status 2-11
operator
  tasks 4-7
  training 4-27
output data formats 1-4

parity checking, value read 1-18
pay-for-production accounting 1-1
personalization A-1
physical planning and installation 3-1
  central facilities maintenance 3-4
  external-device supplier value read 3-36
  installation instructions, value read 3-33
  installation schedule of events 3-1
  planning checklists 3-11
  system installation 3-18
  system planning 3-1
  value read planning 3-29
planning, system 3-1
planning, checklists 3-11
  customer-supplied items 3-16
  electrical and electromagnetic noise 3-12
  floor plan 3-11
  grounding the loop cable 3-12
  loop assignments 3-11
  loop cable characteristics 3-11
  loop cable length requirements 3-13
  loop cable routing 3-13
  preventing electrical and electromagnetic noise 3-12
  Series/1 Data Collection Interactive accessories 3-14
power
  customer-supplied 3-16
  interruption 4-6
  on/off switch 4-2
prepare command 2-4
problem determination guide 4-7
programming considerations 2-13

read ID command 2-3
receptacles 3-16
record code 1-16

schedule of events, installation 3-1, D-1
scheduler card, master 1-5
Series/1 Data Collection Interactive system 1-1
signal cable conversion table 3-43
start command 2-4
start cycle steal status command 2-8
start diagnostic command 2-7
station connector 3-14, 3-15, 3-21, 3-23
stations, entry 1-4
  5234 Time Entry Station 1-10
  5235 Data Entry Station 1-7
  5236 Data Entry Station 1-9
status
  indicators 4-2
    condition codes 2-11
    cycle-steal status words 2-12
    interrupt ID word 2-11
  information 2-11
supervisor key 1-16, 4-5
supplies, required C-1
system
  configuration A-1
  installation 3-18
    ac power 3-18
    contacts closure connector 3-26
    contacts closure housing and cover 3-22
    loop cable 3-18
    loop connector 3-27
    mounting brackets 3-21
    ring out and test total loop 3-28
    station connector addresses 3-25
    station connector housing and cover 3-21
    station connectors 3-23
system planning 3-1

tasks, operator 4-7
terminology, data collection interactive 1-14
test total loop 3-28
time entry station (*see* 5234 Time Entry Station)
time of day 1-8, 1-16, 1-17
time recording 1-1
training, operator 4-27
transaction
  checking definition A-2
  definition A-1

value read
attachment 1-7
attachment 3-6
BCD1 manual mode test 4-14
BCD2 manual protected mode test 4-17
BCD3 semiautomatic and automatic mode test 4-19
entry 1-14
input 1-4
module 1-11
automatic 1-12
manual 1-12
protected 1-12
semiautomatic 1-12
module operation 4-6
parity checking 1-18
planning 3-29
ac power 3-30
checklist 3-29
device-dependent options 3-30
external-device supplier information 3-36
floor plan 3-29
hardware requirements 3-33
mode selection 3-30
signal cable wiring 3-30
tests 4-13
wrap plug installation 4-13
1-of-10A manual mode test 4-21
1-of-10B manual protected mode test 4-23
1-of-10C semiautomatic and automatic mode test 4-25
value read, installation instructions for 3-33
cabling the module 3-34
customer-supplied items 3-33
IBM-supplied items 3-33
mode and option selection 3-34
module mounting bracket template 3-35
signal cable termination 3-34

work-in-process status accounting 1-1
wrap test selection 4-14

1-of-10
dry contact closure 1-11
input 1-11, 3-10

5234 Time Entry Station 1-2
description 1-10
features and specifications 3-9
identification 1-16
operator instructions 4-5
training 4-27
5235 Data Entry Station 1-2
description 1-7
featured specifications 3-6
identification 1-16
operator instruction 4-1
training 4-27

5236 Data Entry Station 1-2
description 1-9
features and specifications 3-8
identification 1-16
operator instruction 4-1
training 4-27
5239 Value Read Module 1-2
description 1-11
features and specifications 3-10
identification 1-16
operator instruction 4-6
training 4-28

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GA34-1567-0

IBM Series/1 Data Collection Interactive
RPQs D02312, D02313, and D02314 Custom Feature

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3-19, 3-20
3-27, 3-28

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Summary of Amendments

Correcting art in Chapter 3.

Note. Please file this cover letter at the back of the manual to provide a record of changes.

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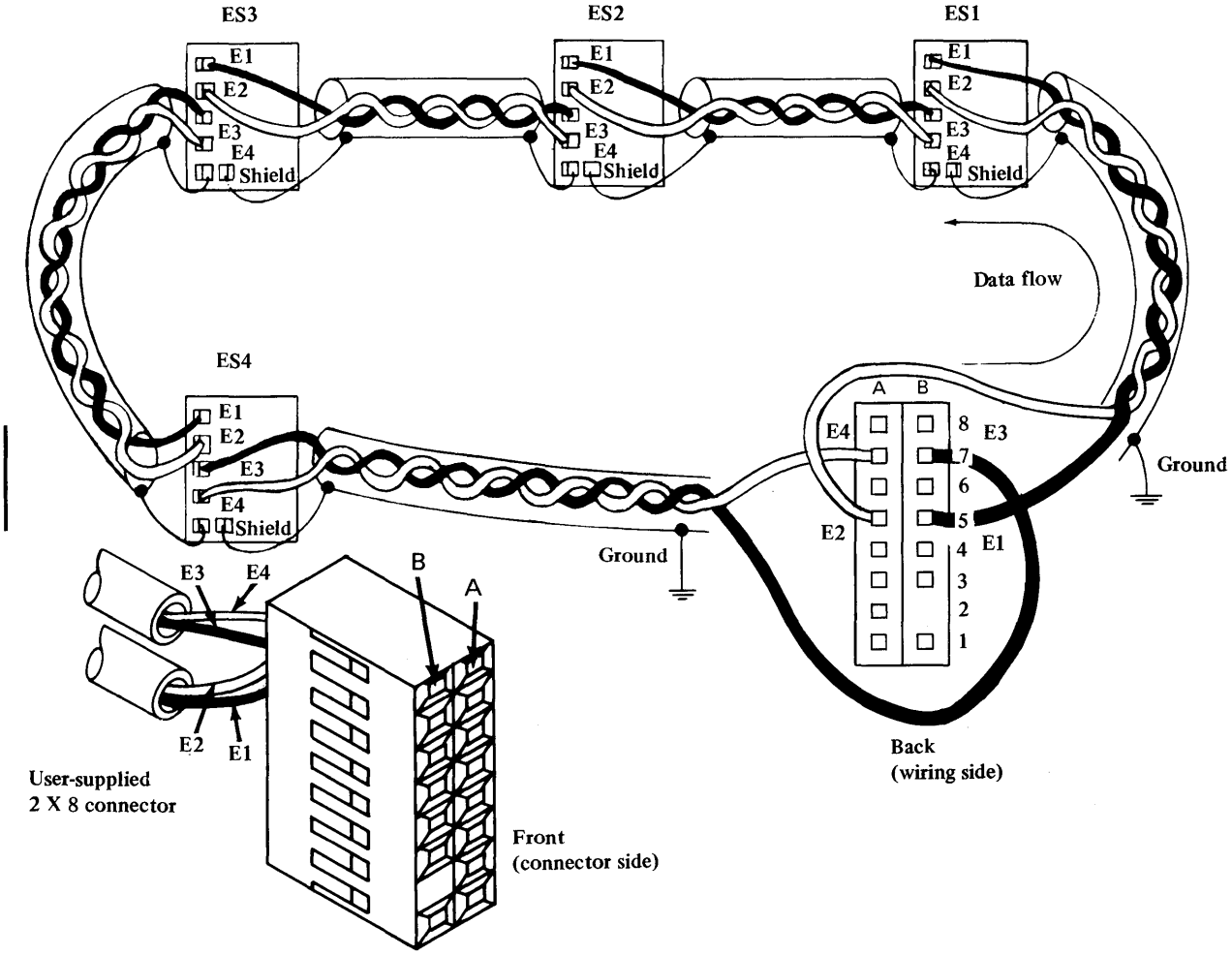


Figure 3-10. Loop cable wiring

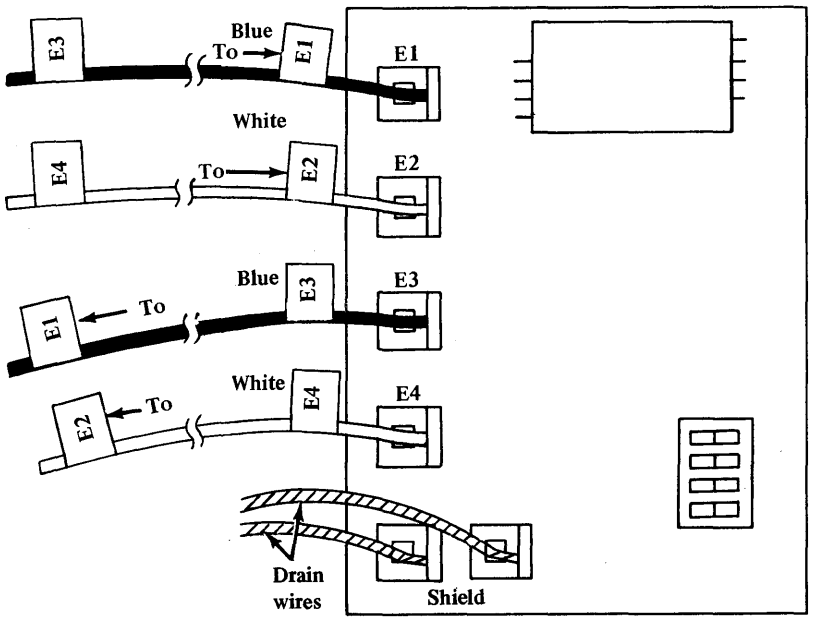


Figure 3-11. Color coding to tab pins

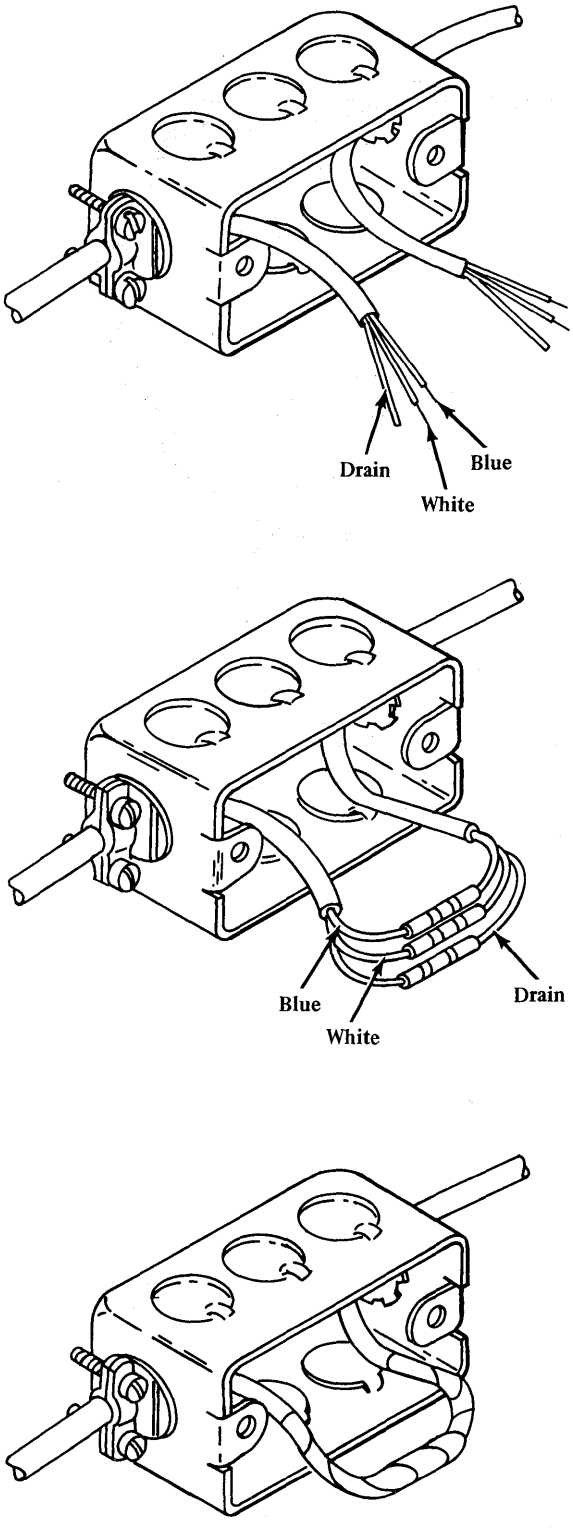
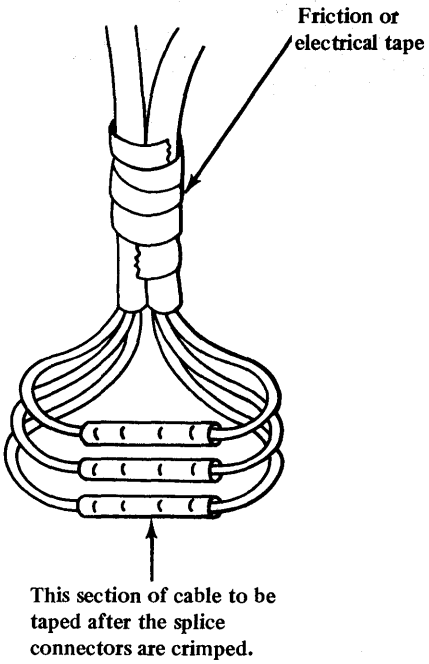


Figure 3-12. Junction box splice

One method of strain relieving a loop cable splice without using a junction box.



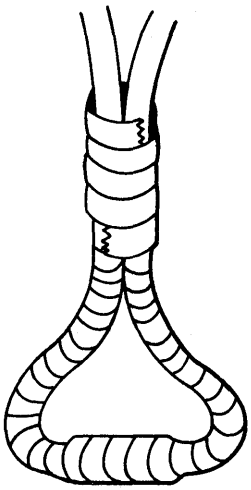


Figure 3-13. Cable splice

Loop Connector

Figure 3-24 shows the loop connector. Use the following procedure to install each loop connector:

( ) Crimp a connector pin to each wire: E1, E2, E3, and E4.

( ) Push wires E1 and E2 into the loop connector from the rear. Ensure that the loop cable labels match the loop connector positions, as shown in Figure 3-24.

( ) Push wires E3 and E4 into the loop connector from the rear. Again, ensure that the loop cable labels match the loop connector positions, as shown in Figure 3-24.

( ) Install connector pins in empty connector positions to ensure tight connection.

( ) Remove 1 inch of outer cable jacket and clamp to Series/1 frame ground.

☐ Repeat this procedure for each loop.

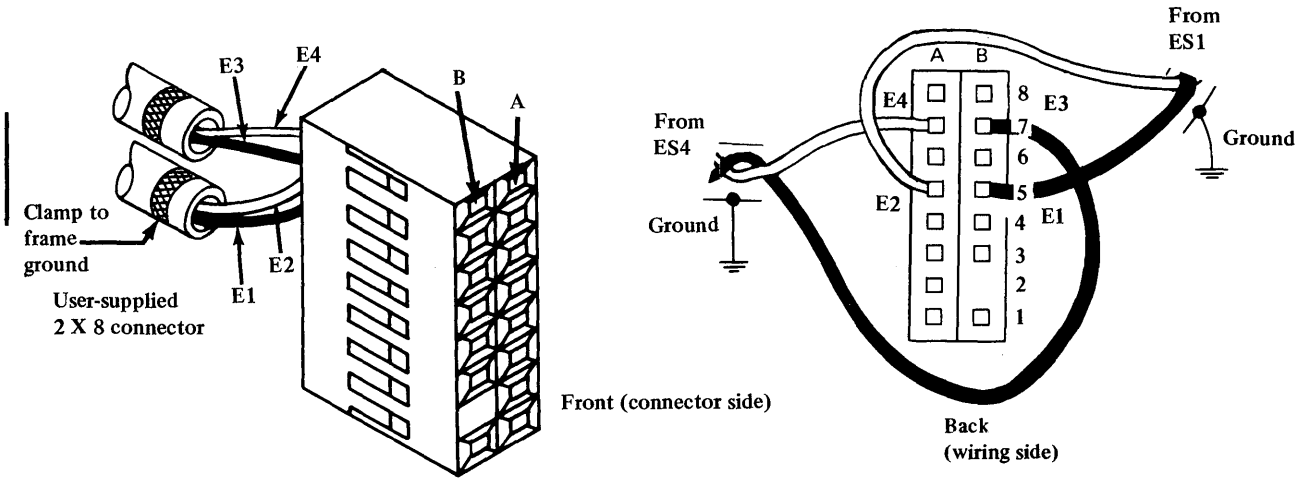


Figure 3-24. Loop connector positions

Ring Out and Test Total Loop

Note: If a problem is encountered at any point in the checkout, the problem must be corrected before continuing.

( ) At the Series/1 location, use the volt-ohmmeter to measure for resistance between E1 and E3, by placing one meter lead into socket E1 and the other meter lead into socket E3 (Figure 3-25).

( ) Repeat for sockets E2 and E4.

( ) Use the following table to determine the maximum resistance allowed:

Loop length	Maximum resistance (ohms)
1525 m (5000 ft)	65
1372 m (4500 ft)	59
1220 m (4000 ft)	52
1067 m (3500 ft)	45
915 m (3000 ft)	39
762 m (2500 ft)	33
610 m (2000 ft)	26
457 m (1500 ft)	20
305 m (1000 ft)	13

( ) Check for an open circuit (no continuity) between E1 and E2.

( ) Check for continuity between both shield drain wires.

( ) Check for no continuity between E1 and shield drain wire.

( ) Check for no continuity between E2 and shield drain wire.

( ) Check that the loop shield is not grounded.

( ) Do not attach loop connectors to the attachment cards.

( ) Repeat this procedure for each loop.

☐ "Ring out" and test total loop.

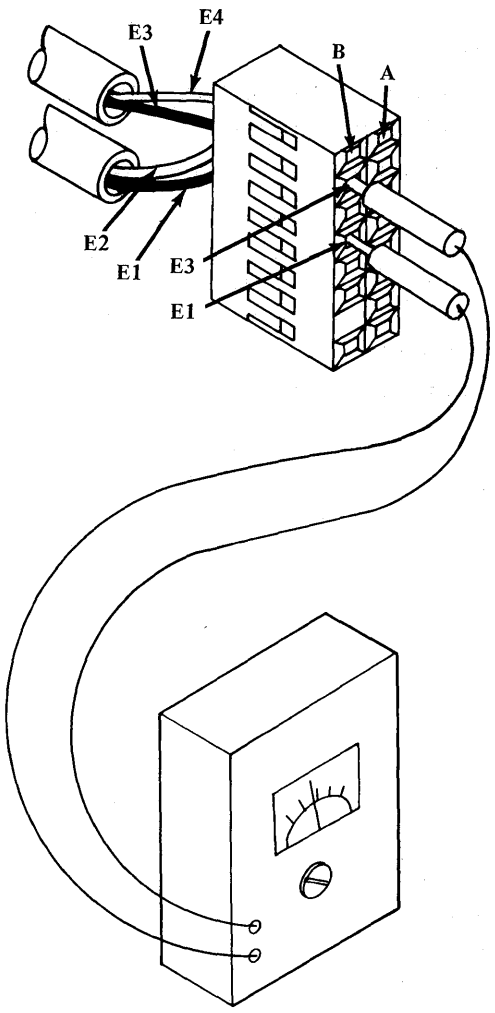


Figure 3-25. DC resistance check

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IBM Series/1
Data Collection Interactive
RPQs D02312, D02313, and D02314
Custom Feature

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This Technical Newsletter provides replacement pages for the subject publication. Pages to be inserted and/or removed are:

1-1, 1-2
1-5, 1-6
1-13, 1-14
3-13, 3-14
3-19, 3-20
3-27, 3-28
E-1, E-2

A technical change to the text or to an illustration is indicated by a vertical line to the left of the change.

Summary of Amendments

The number of entry stations supported by the Data Collection Interactive Attachment has been increased from 31 to 63. An accessories bill of material number has been changed, related RPQs have been added, and minor technical changes have been made.

Note. Please file this cover letter at the back of the manual to provide a record of changes.

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Chapter 1. Description of the Series/1 Data Collection Interactive Attachment Feature

This chapter describes current uses of data collection, and shows how the IBM Series/1 Data Collection Interactive attachment feature expands upon existing methods.

Current Methods of Data Collection

Data is collected by many methods, and for many purposes. The most common methods of data collection are:

- Observation and memory
  This is an inexpensive method of data collection, but it is also generally ineffective.
- Pencil and paper
  This is a common method of data collection, but prone to errors. As a business increases in size, this data becomes cumbersome to handle. If processed by machine, it must be recorded in a machine-readable form to be usable.
- Time clocks
  This is a common method of data collection for employee attendance accounting. Frequently, though, this data must be recorded in another form to be usable; such as, key entries on cards.
- Entry stations
  This is a method of data collection that records actions at their source, the point where the actions take place, yet collects data in machine-usable form at a central location.

In your business, you are collecting data now, and probably by several of the methods described.

Current Uses of Data Collection

Uses of data collection vary from time recording to a comprehensive system for cost and work status accounting. Some of the most common uses of data collection are described here.

Time Recording

Time recording is often a requirement at hospitals, hotels, amusement parks, retail stores, warehouses, airports, printers, and process or manufacturing plants. Any business that hires employees and pays them by the hour needs to collect attendance data.

Pay-For-Production Accounting

Any business paying employees or contractors for the number of items they make, assemble, load, distribute, or install needs to collect "pay-for-production" data. This use of data collection is normally associated with a manufacturing environment, but can also be related to a business charging for services by the hour.

Comparison-To-Standards Accounting

Any business comparing employee or machine efficiency to standards needs to collect production data. This can be a separate data collection system, or can be a part of a system that collects other data; such as, time of attendance. Often, a simple time collection system can be expanded to a "comparison-to-standards" system with very little additional effort or cost. This use of data collection is normally associated with a plant environment, but can also be related to a service business.

Work-In-Process Status Accounting

A business that has many items being scheduled through a plant at one time frequently needs to know the status of a particular item and when it will be completed. Schedules change, and as they do, work priorities change. Items in-process must be located and rescheduled. Frequently, a particular job must be expedited and traced through to completion. This use of data collection is normally associated with a plant environment, but it can also apply to a complex project requiring many steps being completed according to a master schedule.

Inventory Control Accounting

A business that inventories many items of various quantities needs to collect inventory data. This is often a requirement for a retail store, a wholesale distributor, a manufacturer who maintains an inventory of parts, or the circulation department of a library.

Action Accounting

A business that needs to record when employees perform their duties requires action completion data. An example of this is recording the dispensing of medication at a hospital, or clocking the checkpoint stations of a security guard.

Cost Accounting

Any business that manufactures more than one part or product needs to know what costs are associated with which part or product. This is necessary to determine which products are contributing to the profit of the company, and which products are being made at an unsatisfactory profit. This information is vital to determine whether to make or purchase a part, increase effort on one product, or reduce or eliminate effort on another. This use of data collection is normally associated with manufacturing operations.

Series/1 Data Collection Interactive Attachment Feature

The Series/1 Data Collection Interactive attachment feature is a simple and convenient way for the production employee to enter data:

- At the place of the action
- At the time of the action
- In a form that becomes machine readable

The Series/1 Data Collection Interactive attachment feature is flexible. This system can first be installed to perform some simple data collection task, such as time recording. Then, it can be expanded to a system for collecting data so that a computer can calculate cost per product and compare machine efficiency to standards. Your Series/1 Data Collection Interactive attachment feature does not give you a data collection solution that is unalterable, but rather gives you a versatile solution that you can change to encompass new uses in a changing environment. A Series/1 Data Collection Interactive attachment feature, as shown in Figure 1-1, can have:

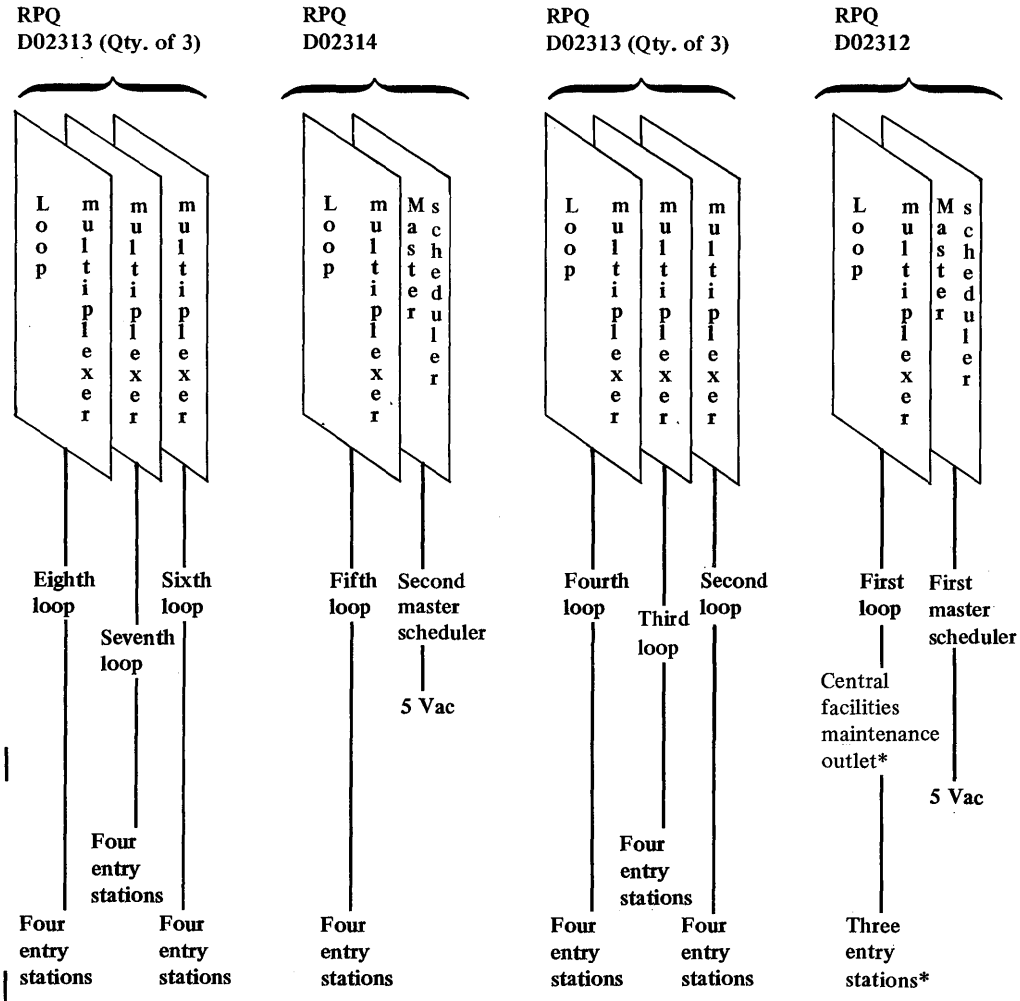
- Up to 63 entry stations
  - 5235 Data Entry Stations for card, key, badge, and value read entry
  - 5236 Data Entry Stations for card, key, badge, and value read entry
  - 5234 Time Entry Stations for badge entry only
  - 5239 Value Read Modules for BCD/TTL parallel or 1-of-10 dry contact input
- One Series/1 with appropriate RPQs (D02312, D02313, and D02314)
  - The Series/1 processor collects data from entry stations; then, with proper programming, it produces reports for customer use, or stores data for future use.
- Attachment feature card RPQs
  - A loop multiplexer card
  - A master scheduler card

Loop Multiplexer and Master Scheduler Cards

The Data Collection Interactive attachment feature resides in the Series/1 Processor or IBM 4959 Input/Output Expansion Unit, and consists of two attachment feature cards (see Figures 1-2 and 1-3). One card contains the master scheduler and the other contains the loop multiplexer.

The master scheduler controls the interface between the Series/1 and the loop multiplexer. Up to four loop multiplexers can be controlled by one master scheduler, with a maximum of four master schedulers per system. The loop multiplexer cards do not respond to Series/1 I/O channel commands except to propagate the I/O channel 'poll' signal.

The loop multiplexer drives the loop for up to four data entry stations.



Minimum configuration =
1-RPQ D02312 (three entry stations)

Maximum configuration =
2-RPQ D02312 (7 stations)*
12-RPQ D02313 (48 stations)
2-RPQ D02314 (8 stations)
= 63 entry stations

*When a second RPQ D02312 is used, no central facilities maintenance outlet is required on that loop; therefore, four entry stations may be attached.

Figure 1-2. A sample configuration of Series/1 Data Collection Interactive RPQs

Series/1 Data Collection Interactive Basic Features

The Series/1 Data Collection Interactive is made up of entry stations and a Series/1 with appropriate Data Collection Interactive RPQs (D02312, D02313, and D02314).

The entry stations are located as near as possible to the data being collected. This can be at a receiving department, beside a machine in a manufacturing department, at the employee entrance to a hotel, or at a nurses' station of a hospital.

There are three types of entry stations: the 5235 Data Entry Station, shown in Figure 1-4; the 5236 Data Entry Station, shown in Figure 1-5; and the 5234 Time Entry Station, shown in Figure 1-6. The 5239 Value Read Module is shown in Figure 1-7.

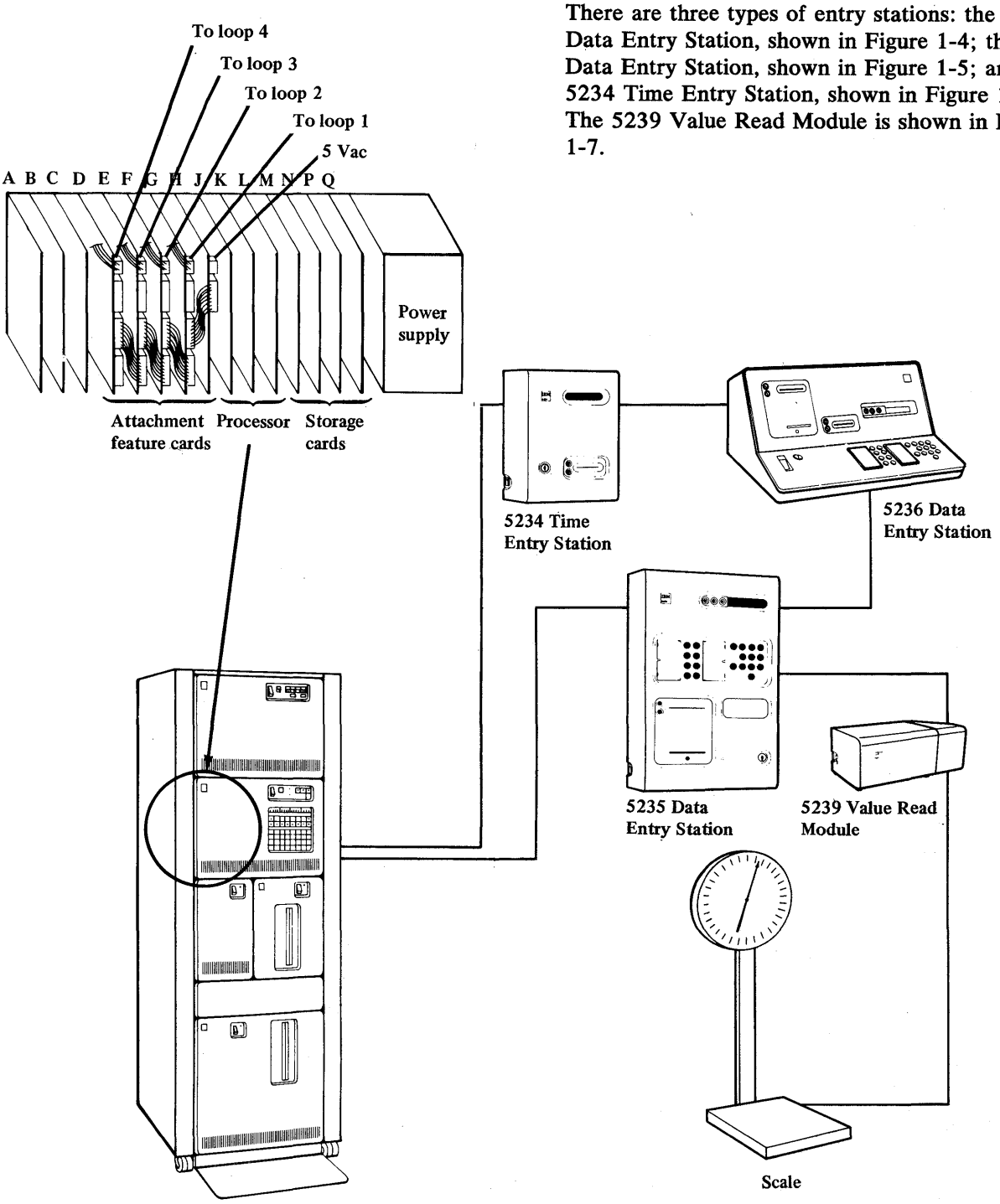


Figure 1-3. A sample configuration of a Series/1 Data Collection Interactive system

Series/1 Data Collection Interactive Loops

The Series/1 Data Collection Interactive system can have up to 63 entry stations. These entry stations are attached to two-wire cables called loops. Each loop is attached to a multiplexer card in the Series/1. The first loop can have up to three entry stations plus the Central Facilities Maintenance (CFM) outlet; additional loops can have up to four entry stations. Each loop can be up to 1525 meters (5000 ft) long, and entry stations on a loop can be a maximum distance of 610 meters (2000 ft) apart.

The Series/1 Data Collection Interactive shown in Figure 1-8 has two loops. The first loop (loop 1) has three entry stations; the other loop has four entry stations. The Series/1 collects data entered through entry stations. This data is then processed by the Series/1.

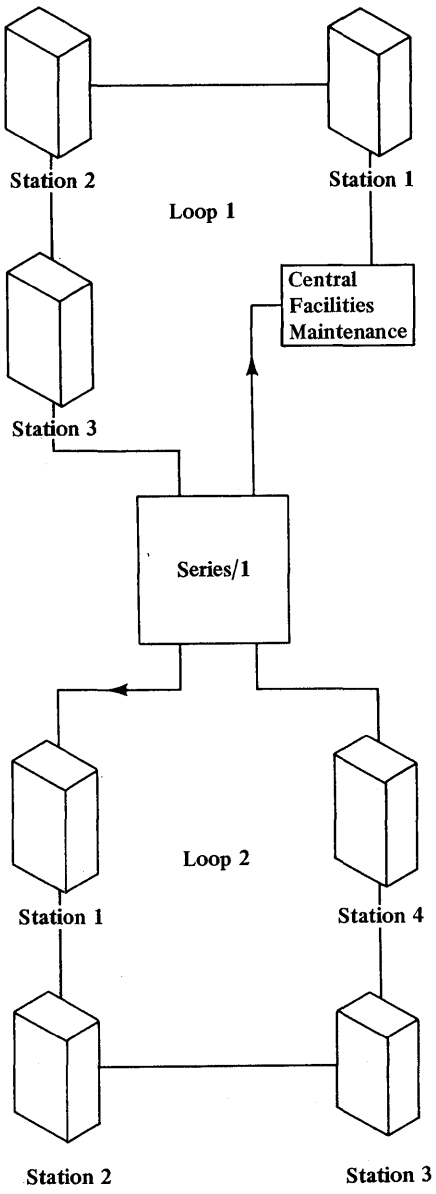


Figure 1-8. Series/1 Data Collection Interactive with two loops

Series/1 Data Collection Interactive Terminology

The Series/1 Data Collection Interactive system has four types of entry:

- Badge entry
- Card entry
- Key entry
- Value read entry

Entering data at an entry station is called an action, which can be composed of any one or a combination of the four types of data entry. The entries for an action are accumulated within the loop multiplexer in an area of storage called an interface data register.

An action is completed when all required entries are made. When the action is completed, the loop multiplexer transmits the data stored in the interface data register to the scheduler buffer, as shown in Figure 1-9. The scheduler transmits the buffers to the Series/1 processor in one of two formats: a data buffer or a badge buffer.

The format of a specific action is determined by programmed personalization. (See Appendix A. "Personalization" for further information.)

The buffer is described in this manual as either a data buffer or a badge buffer. A data buffer consists of an action that can have a combination card, key, value read, and *one* badge entry. A badge buffer can have up to eight badge entries.

The badge buffer reduces the number of records created when many badges are being entered, and it increases the number of badges that can be entered in a given period of time. This can be of considerable importance at times of peak activity, such as attendance recording at the beginning or the end of a shift.

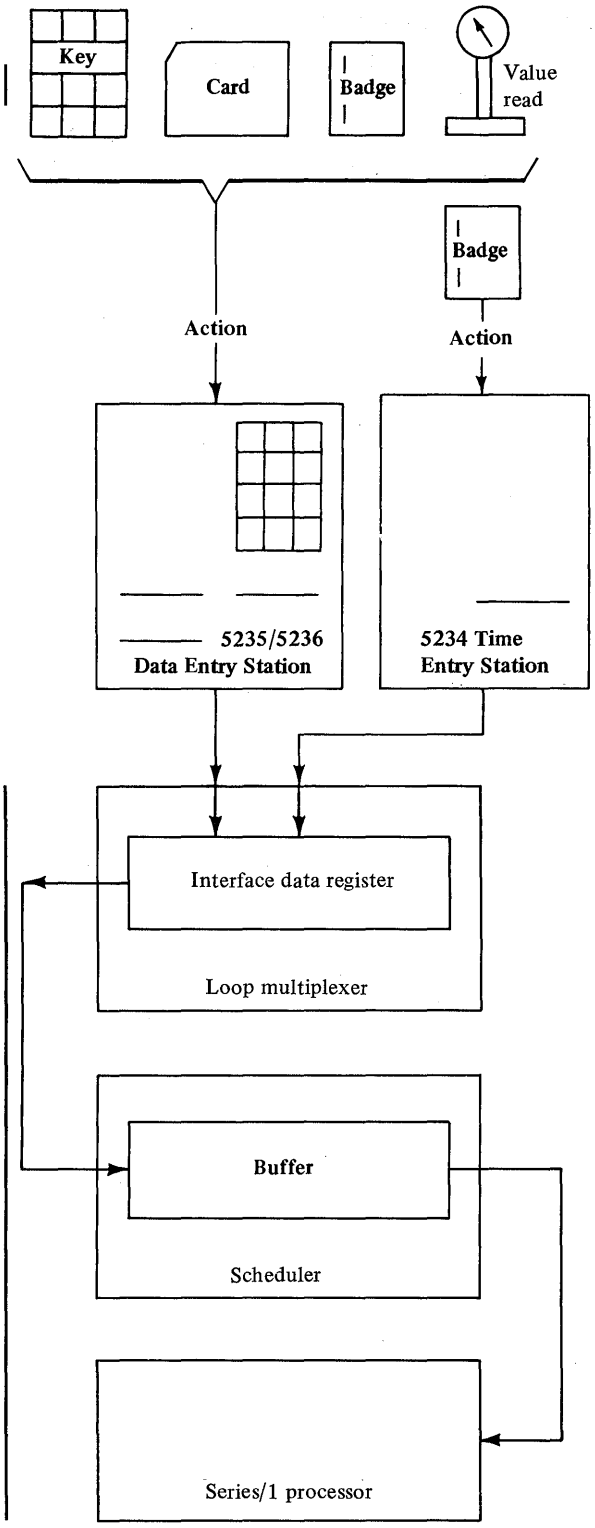


Figure 1-9. Records created for actions

Loop Cable Length Requirements

The length of the loop cable must be considered when locating the entry stations.

The following information is provided to assist you in understanding the loop cable length requirements:

( ) Maximum length between operating entry stations is 610 m (2000 ft).

( ) Maximum length between the Series/1 and the first entry station or the Series/1 and the last entry station is 610 m (2000 ft).

( ) Recommended length is 305 m (1000 ft) between operating entry stations. This allows for bypassing an entry station requiring servicing, and still mainaining the 610-m (2000-ft) maximum cable length between entry stations.

( ) Maximum combined length of each loop is 1525 m (5000 ft).

( ) When determining cable lengths, allow for sufficient ceiling drop.

☐ When you understand the loop-length requirements, proceed to loop-cable routing to establish your cable lengths.

Loop Cable Routing

To calculate the length of loop cable required for your installation, the routing of each loop should be laid out on your floor plan. When planning the loop-cable routing, consider the following:

( ) Loop cables between buildings may be buried underground in conduit (plastic or metal) or run overhead on a suitable "messenger wire" for strain relief.

( ) To obtain maximum life expectancy from the cable, it should be buried in a conduit when it is installed outdoors.

Note: Over an extended period, a cable installed outdoors may fade or discolor.

( ) Allow sufficient cable for ceiling to floor drops, vertical and horizontal offsets, routings around obstructions, and electrical noise sources.

( ) No more than one loop cable splice should be used in any cable segment (distance between stations and Series/1 to the first and last station).

( ) Calculate the amount of loop cable required.

( ) Determine the quantity of 152-m (500-ft) and/or 305-m (1000-ft) spools required. Round off to the nearest 152-m (500-ft) spool.

☐ Indicate the length of loop cable required for each section of the loop on your floor plan.

Series/1 Data Collection Interactive Accessories

Figure 3-8 shows the IBM Series/1 Data Collection Interactive accessories.

The accessories you order should include:

( ) Station connectors (one per station plus a spare). Insulated crimp-type push on terminals and splice connectors are included for 20-AWG loop wire.

( ) Station-connector receptacle box, cover, and strain relief (one each per station connector) outside USA and Canada only

( ) Station mounting bracket (one per station)

( ) Loop wire, required for connecting all entry stations to the Series/1. This wire is twisted pair, 20 AWG, shielded, with drain wire for terminating shield.
- 152-m (500-ft) spools
- 305-m (1000-ft) spools

( ) Contacts closure connectors (one for each station having this option). Insulated crimp-type push-on terminals and splice connectors are included for 18–22-AWG wire.

☐ Order IBM accessories or equivalents 10 weeks before your installation.

Accessories With Bill of Material Number

- Entry station mounting bracket—2461781
- Crimp-on splice connector—0523176
- Loop connector and crimp contact—8327397
- Station connector assembly—2461780 (Note 1)
  When you order the station connector assembly, you receive:

  Station connector
  Push-on terminals
  Station address and loop label
  Crimp-on splice connector
  Screws
- Contacts closure connector assembly—4413082 (Note 2)
  When you order the contacts closure connector assembly, you receive:

  Contacts closure connector
  Push-on terminals
  Crimp-on splice connector
  Screws
- Loop cable, 152-m (500-ft) spools—2461783
- Loop cable, 305-m (1000-ft) spools—2461784
- Station connector housing assembly—2461782 (for non-USA and Canada installation only)
  When you order the station connector housing assembly, you receive:

  Receptacle box
  Cover
  Strain relief
  Screws

Notes:

1. You should always keep a spare station connector assembly on hand. This spare should be ordered with the initial Series/1 Data Collection Interactive system order and replenished if used.
2. The contacts closure connector assembly is required for each entry station with the contacts closure option.

Related RPQs

- Loop attachment panel, RPQ D02355
- Loop attachment cable(s), RPQ D02356
- Loop connector—1847530, RPQ D02355/56
- Loop connector pins —1661132, RPQ D02355/56

For further information, contact your IBM representative.

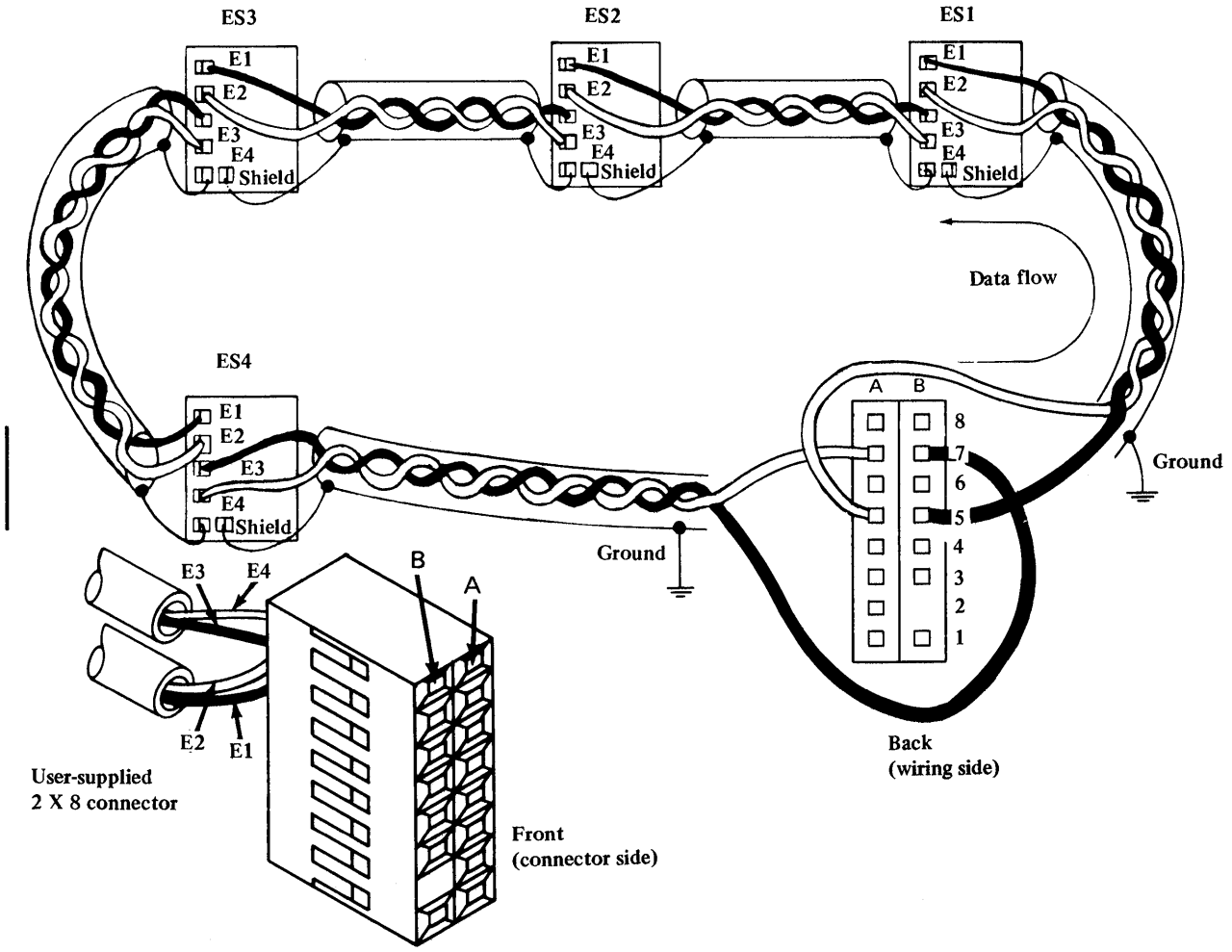


Figure 3-10. Loop cable wiring

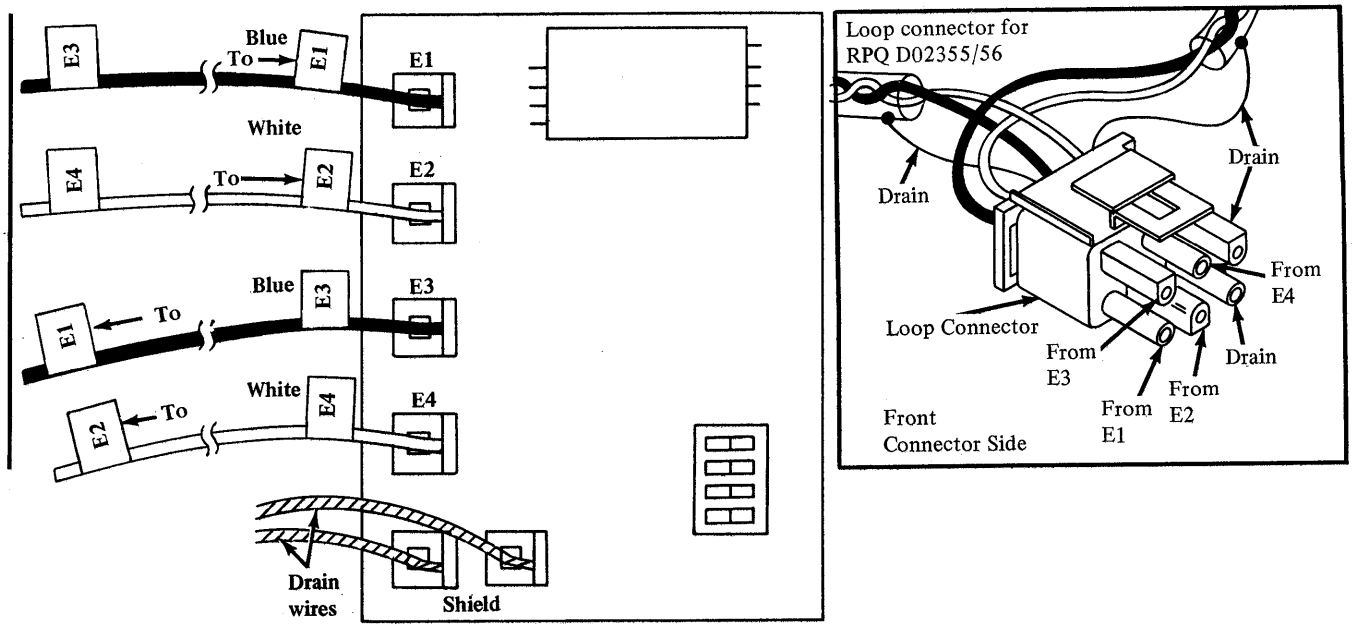


Figure 3-11. Color coding to tab pins

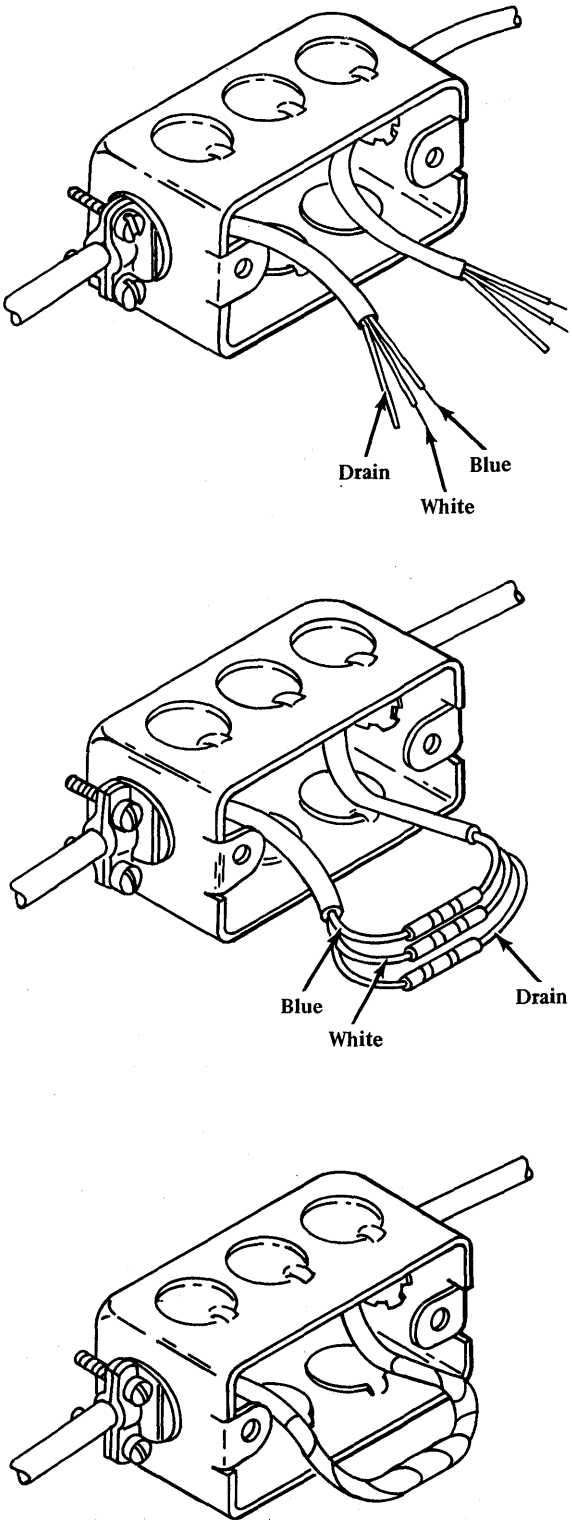
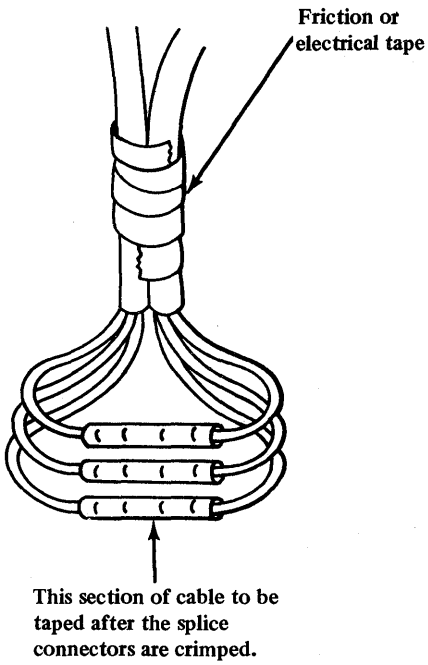


Figure 3-12. Junction box splice

One method of strain relieving a loop cable splice without using a junction box.



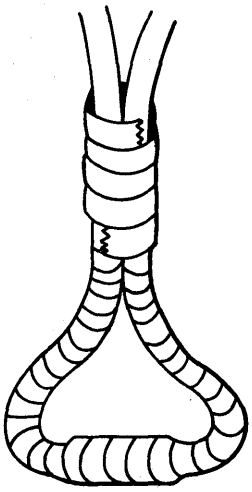


Figure 3-13. Cable splice

Loop Connector

Figure 3-24 shows the loop connector. Use the following procedure to install each loop connector:

( ) Crimp a connector pin to each wire: E1, E2, E3, and E4.

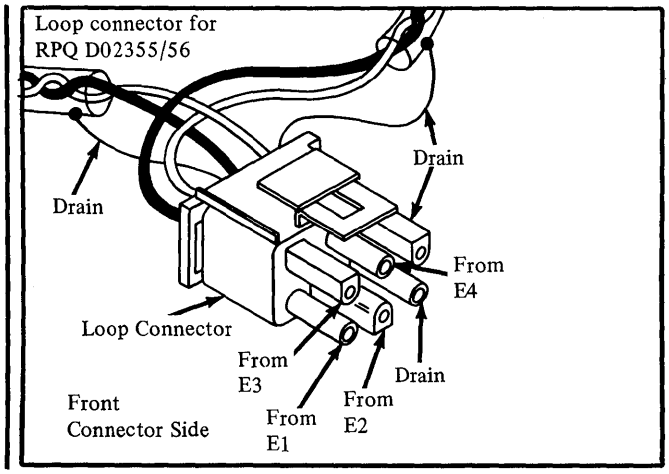
( ) Push wires E1 and E2 into the loop connector from the rear. Ensure that the loop cable labels match the loop connector positions, as shown in Figure 3-24.

( ) Push wires E3 and E4 into the loop connector from the rear. Again, ensure that the loop cable labels match the loop connector positions, as shown in Figure 3-24.

( ) Install connector pins in empty connector positions to ensure tight connection.

( ) Remove 1 inch of outer cable jacket and clamp to Series/1 frame ground.

☐ Repeat this procedure for each loop.



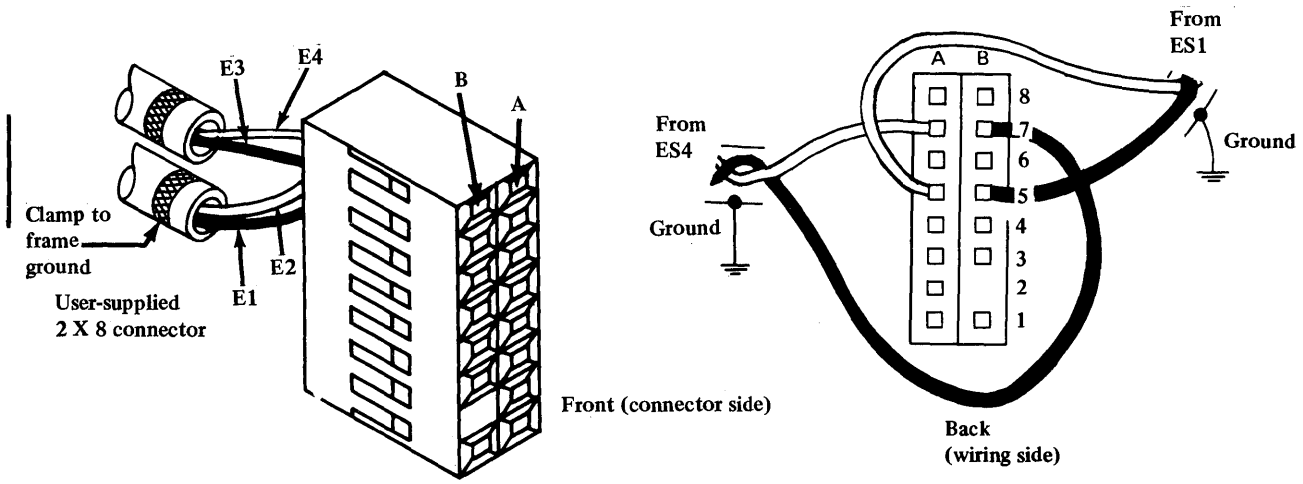


Figure 3-24. Loop connector positions

Ring Out and Test Total Loop

Note: If a problem is encountered at any point in the checkout, the problem must be corrected before continuing.

( ) At the Series/1 location, use the volt-ohmmeter to measure for resistance between E1 and E3, by placing one meter lead into socket E1 and the other meter lead into socket E3 (Figure 3-25).

( ) Repeat for sockets E2 and E4.

( ) Use the following table to determine the maximum resistance allowed:

Loop length	Maximum resistance (ohms)
1525 m (5000 ft)	65
1372 m (4500 ft)	59
1220 m (4000 ft)	52
1067 m (3500 ft)	45
915 m (3000 ft)	39
762 m (2500 ft)	33
610 m (2000 ft)	26
457 m (1500 ft)	20
305 m (1000 ft)	13

( ) Check for an open circuit (no continuity) between E1 and E2.

( ) Check for continuity between both shield drain wires.

( ) Check for no continuity between E1 and shield drain wire.

( ) Check for no continuity between E2 and shield drain wire.

( ) Check that the loop shield is not grounded.

( ) Do not attach loop connectors to the attachment cards.

( ) Repeat this procedure for each loop.

☐ "Ring out" and test total loop.

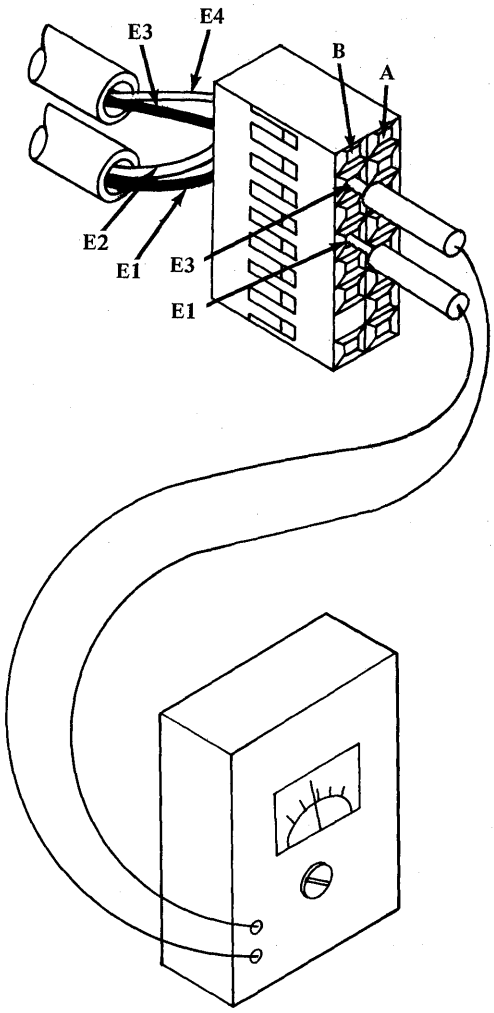


Figure 3-25. DC resistance check

Appendix E. Control Diskette

An IBM diskette is supplied with each RPQ D02312. The data on this diskette must be loaded into the RPQ D02312 scheduler and the RPQ D02314 scheduler, if installed, everytime the Series/1 is powered down and then powered up again.

Program RPQ P82600, if installed, contains the instructions necessary to make this diskette data part of your IPL program after an initial installation procedure.

If RPQ P82600 is not installed, retrieve the data from the RPQ D02312/14 control diskette and load it to a data set, which you create on your disk or diskette. This data will become part of your initial program load (IPL). (Data transfer from the control diskette to your data set is required only once). The data of this data set must be written to the RPQ D02312/14 scheduler(s) during the first IPL after power up.

On every subsequent IPL, perform a check to ensure that the control data has been previously loaded to the RPQ D02312/14 scheduler(s). This is done by reading two bytes from random access memory locations '08FE' and '08FF'. If both locations are 0's, write the control data from your data set to the RPQ D02312/14 scheduler(s). See the DCB information in this section (Second Read Transfer Test Pattern command) for the command used to perform this check.

An attempt to write the control data to the scheduler(s) when locations '08FE' or '08FF' are not 0's results in an exception interrupt with specification check (bit 3) set in the ISB.

The RPQ D02312/14 control diskette is a basic exchange format diskette with 128-byte records. There are three header records on cylinder 0, sectors 8, 9, and 10, that point to three identical copies of data: RAMDATA1, RAMDATA2, and RAMDATA3, respectively. Each copy is 256 bytes long. Refer to the *IBM Series/1 4962 Disk Storage Unit and 4964 Diskette Unit Description*, GA34-0024, for the necessary disk or diskette I/O commands.

Contents	From		To		Length (bytes)
	Track	Sector	Track	Sector	
HDR1 RAMDATA1	00	008	N/A	N/A	128
HDR1 RAMDATA2	00	009	N/A	N/A	128
HDR1 RAMDATA3	00	010	N/A	N/A	128
RAMDATA1	(See Note)	(See Note)	(See Note)	(See Note)	256
RAMDATA2	(See Note)	(See Note)	(See Note)	(See Note)	256
RAMDATA3	(See Note)	(See Note)	(See Note)	(See Note)	256
Note: See header information for data location.					

The commands used for data transfer between Series/1 storage and the RPQ D02312/14 scheduler(s) are Write/Read Transfer Test Pattern commands. The IDCB used for those commands is a standard Start I/O command, as explained in Chapter 2.

For Write/Read Transfer Test Pattern commands to be used successfully as part of the RPQ D02312/14 control diskette data loading procedure, the DCB words must be coded as follows:

First Write Transfer Test Pattern command (write data)

DCB word 0—control word = 0060 (hexadecimal)

DCB word 1—attachment storage address = 0800 (hexadecimal)

DCB word 6—byte count = 00FE (hexadecimal)

DCB word 7—data address that points to the beginning of the diskette data in Series/1 storage

Second Write Transfer Test Pattern command (enable data)

DCB word 0—control word = 0060 (hexadecimal)

DCB word 1—attachment storage address = 08FE (hexadecimal)

DCB word 6—byte count = 0000 (hexadecimal)

DCB word 7—data address that points to the last byte minus 1 of the diskette data in Series/1 storage

First Read Transfer Test Pattern command

DCB word 0—control word = 2060 (hexadecimal)

DCB word 1—attachment storage address = 0800 (hexadecimal)

DCB word 6—byte count = 0100 (hexadecimal)

DCB word 7—data address, in Series/1 storage, that points to the beginning of a read buffer.

Second Read Transfer Test Pattern command (to check locations '08FE' and '08FF'):

DCB word 0—control word = 2060 (hexadecimal)

DCB word 1—attachment storage address = 08FE (hexadecimal)

DCB word 6—byte count = 0002 (hexadecimal)

DCB word 7—Series/1 storage address = XXXX

Note: DCB words not listed in this chart should be set to 0's.

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