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VEEDER-ROOT
INSTALLATION, OPERATION
AND PROGRAMMING MANUAL

Technical Manual
Issued: 8/88
Supersedes: 5/88

SERIES 7935 PRODUCTION DATA CONTROL

Manual No. 576013-216



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SECTION 1.0 INTRODUCTION

1.1 GENERAL

This manual contains instructions for installation, operation and programming procedures for the Series 7935 Production Data Control.

When a vertical bar ▌ appears adjacent to text or illustrations, information has been added or changed at the last issue date.

Consult Veeder-Root on any unusual application, installation or possible modification of this basic design.

1.2 DESCRIPTION

Veeder-Root's Series 7935 Production Data Control provides a modern effective means of obtaining, displaying and evaluating production information.

Careful analysis of this information can help identify material bottlenecks, poor operator performance, chronic machine failures and other persistent problems that reduce productivity.

Up to 32 7935s may be networked to a personal or large scale computer system via an RS-422 data interface. The computer can perform additional analysis of the 7935's data and produce reports by exception, grouping statistic or any other programmable presentation.

When connected to existing sensors or accessory sensing devices, the following data is easily monitored on the unit's LED display or transmitted to a computer:

SHIFT TOTALS — Quantity produced, such as pieces, gallons, feet, etc., segregated by work shift. Up to five shifts may be accommodated to account for swing-shifts, weekend shifts, etc. An alternate application of the shift total registers would be keeping count of five product variations produced by the monitored equipment.

RUNNING TOTAL — A running total of production quantity. This register may be reset independently of shift totals.

PRESET COUNTER — Provides automatic control of machine or process by predetermined count. Ideal for batching, cut-to-length, packaging, spooling, filling, and other repetitive operations. Two limits activate independent control outputs for accurate dual stage automation.

RATE OR SPEED — The actual running speed of the machine or process. This may be expressed in virtually any unit of rate such as revolutions, feet, gallons, pieces, etc., per minute or per hour. A secondary rate or speed can also be monitored. This is ideal for complex processes that require the balancing of two rates. For example, in a twisting process, the material delivery rate (feet/minute) and the twisting head speed (rpm) would be monitored.

Note: The 7935's counting and rate registers are each associated with a separate calibration factor. This allows maximum flexibility in accommodating an existing or easily obtained input signal as well as permitting different engineering units to be provided by each function. For example, shift totals in barrels, rate in gallons per minute, and preset count in quarts is possible.

RATIO — The numerical ratio between two rate measurements. This feature allows easy and accurate synchronization of two independent but related speeds.

DOWNTIME — The amount of time segregated by work shift that the machine or process was not operating.

EFFICIENCY — The percentage of productive time vs. downtime segregated by shift. For example, if the total elapsed time of the current work shift is four hours, but one hour was nonproductive, the efficiency is 75 percent. Previous work shift final efficiencies are retained in memory.

FAULT REASON ANALYSIS — Monitors up to seven inputs from external detectors or manual switches to identify the causes of nonproductive time or flawed product. The number of occurrences and total amount of downtime for each type of fault is stored in memory and can be segregated for up to five work shifts. This information can be retrieved easily from the front panel display or through the RS-422 external communications interface.

1.3 APPLICATIONS

The Series 7935 is ideal for virtually all continuous production process applications including those in the metals, chemical, textile, wire, cable and paper industries.

Evaluation of process variables, equipment performance and operator ability requires a source of accurate reliable information. The 7935 is a powerful tool in the acquisition and evaluation of this information.

The 7935's preset counter allows automatic control of lot or batch quantities, greatly reducing waste by eliminating under and overruns.

When one or more 7935 (up to 32 units) are networked to a computer, the application is greatly enhanced. Reports can be generated for inventory control, problem analysis, equipment maintenance, production standards and so on.

SECTION 2.0 SPECIFICATIONS AND FEATURES

2.1 PHYSICAL SPECIFICATIONS

Display: Red LED, six data digits, two identification digits; programmable decimal point location.

Display Size: 0.56 inch (1.42 cm) digit height.

Front Panel: Laminated structure with membrane switch push buttons. Moisture and dust tight when unit is panel mounted with gaskets.

Enclosure Material: Polycarbonate, SE1 rating.

Enclosure Dimensions: Refer to Figure 2-1, Dimensions.

Mounting: Panel mount, hardware provided.

Weight: 3 lbs. (1.36 kg).

2.2 ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 32°F to 131°F (0°C to 55°C).

Storage Temperature: -40°F to 160°F (-40°C to 70°C).

Operating Humidity: 85% noncondensing, maximum.

2.3 POWER REQUIREMENTS

Supply Voltage: 115/230 VAC (±10%) 50/60 Hz.

Power Consumption: 20 watts, maximum.

Nonpowered Memory Retention: All programmed and acquired data is retained in solid-state, nonvolatile memory (NOVRAM).

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2.4 INTERFACE SPECIFICATIONS

2.4.1 Inputs

The following inputs are provided as standard:

Primary Input: Accepts count signals for operation of shift totalizing, running total, preset counter and Rate-1 features.

Secondary Rate Input: Accepts count signal input for Rate-2 and, in conjunction with Rate-1, provides ratio feature operation.

Input Device: Open collector NPN transistor (high-speed mode) or switch/relay contact (low-speed mode).

Pulse Rate:
High-speed mode: 1 KHz.
Low-speed mode: 25 Hz.

Pulse Width:
High-speed mode: 500 microseconds, minimum.
Low-speed mode: 20 milliseconds, minimum.

Logic "0": Contact open or transistor off.

Logic "1": Contact closed or transistor on.

Contact or Collector Loading: 15 volts/3 mA. Sink.

Direction Input: Status input that can reverse the counting direction of the shift totalizer and preset counter. From contact or open collector NPN transistor.

Command Status: Contact open (transistor off) provides forward counting direction. Closed contact (transistor on) provides reverse counting direction.

Reversal Time: 50 milliseconds, maximum.

Contact or Collector Loading: 15 volts/3 mA. Sink.

Run/Stop Input (all models): Status input for operation of shift down time (or up time) features. Also for running hours accumulation. From contact or open collector NPN transistor.

Command Status: Contact open (transistor off) provides shift down time accumulation. Contact closed (transistor on) provides running hours accumulation.

Contact or Collector Loading: 15 volts/3 mA. Sink.

Remote Reset Input: Command input for electrical reset of preset counter feature only. From normally open contact or open collector NPN transistor.

Reset Cycle Time: 50 milliseconds, maximum.

Contact or Collector Loading: 15 volts/3 mA. Sink.

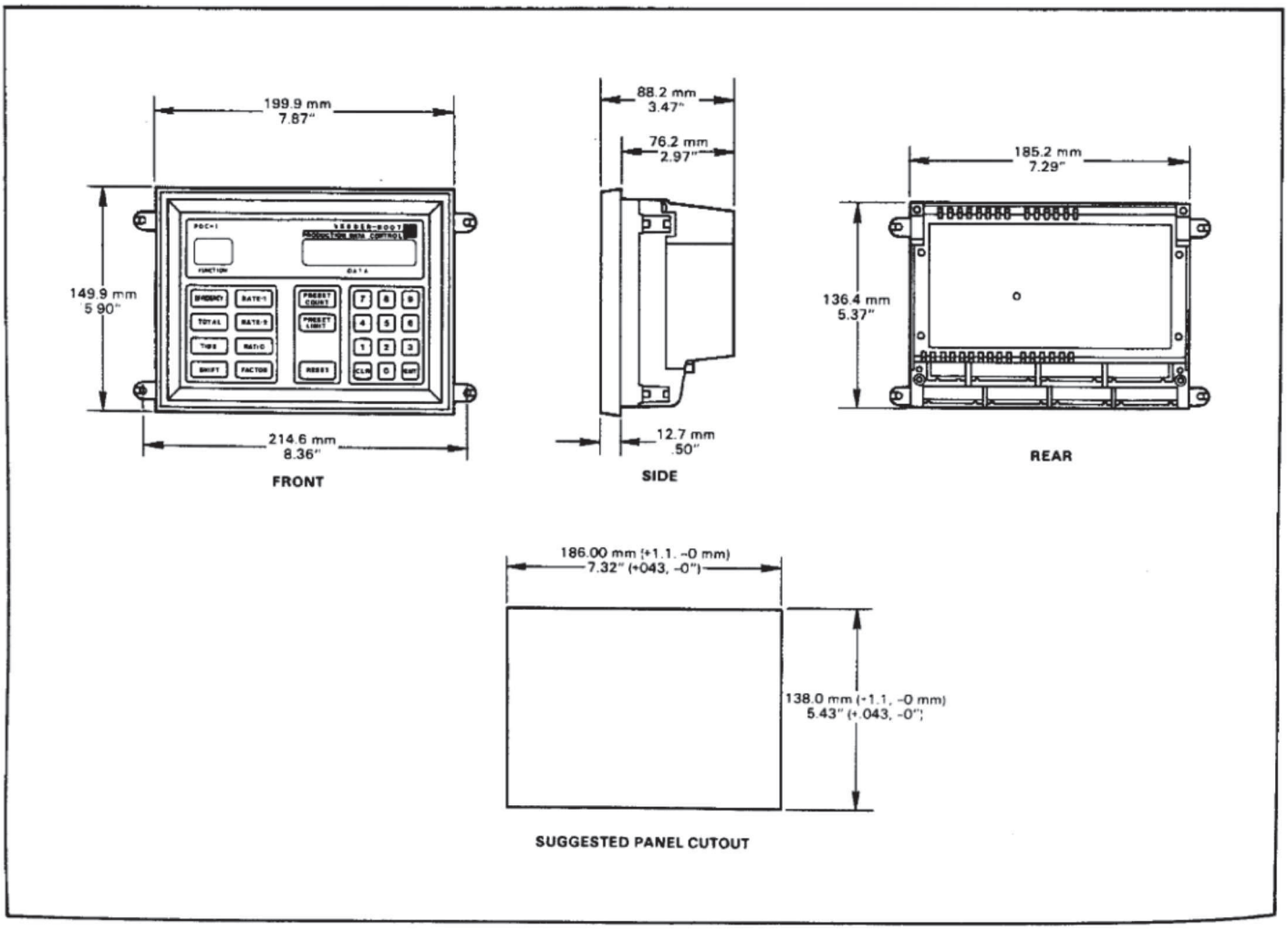


Figure 2-1. Dimensions

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Security Input: Status input for protection of reset and programming functions. May be connected to external key-lock switch (or open collector NPN transistor). Use of this input is not necessary when front panel digital code security method is employed.

Command Status: Contact open (transistor off) prevents access to reset and programming functions. Contact closed (transistor on) allows access to functions.

Contact or Collector Loading: 15 volts/3 mA. Sink.

Fault Reason Inputs (Fault Reason Analysis Feature): Seven individual status inputs for use with external detectors or manual switches. Provides signal to monitor total count and elapsed time of fault events. From contact or open collector NPN transistor.

Command Status: Inputs individually programmable for closed/open status (transistor on/off) to signify fault condition.

Contact or Collector Loading: 15 volts/3 mA.

Response: To be detected, fault must be present for 1/2 second. Signal must be present for full duration of fault in order to obtain correct elapsed time.

2.4.2 Outputs

The following outputs are provided as standard in all models:

Preset Counter Outputs: Separate relay and transistor outputs for both limits.

Relay Rating:
Resistive: 5A 230 VAC, 3A 30 VDC.
UL, CSA: 1/6 HP 125, 230 VAC.
Type: Form C (single pole/double throw).
Load Voltage: 230 VAC, maximum.
Load Current: 5 amp maximum, noninductive.

Transistor Rating:
Type: NPN, open collector.
Load Voltage: 30 VDC, maximum.
Load Current: 100 mA, maximum.
Voltage Drop: 1.2 volts, maximum, at full rated load current.

Output Methods: Choice of latching or momentary operation. Momentary hold time programmable over range of 50 milliseconds to 12.75 seconds, in 50 millisecond steps.

Sensor Power Supply: DC power output for use with external sensors or other auxiliary devices.

Voltage: 15 VDC regulated, ±5%.

Current: 120 mA, maximum.

2.4.3 Data Capabilities and Formats

The following information is available from the Series 7935's front panel display and via the data communications interface.

Shift Totals: Six digits, count to 999999. Programmable decimal point for tenths.

Running Total: Same as "Shift Totals."

Totals Presentation: Scaling factor allows calibration to specific engineering unit (see "Scaling Factors").

Downtime: Six digits with decimal point for tenths. Range 99999.9 minutes.

Efficienty: Four digits, range from 00.0% to 100.0%.

Rate-1: Six digits with programmable decimal point for tenths. Selectable operation: Rate per minute or rate per hour.

Rate-2: Same as "Rate-1."

Rate Presentation: Separate scaling factors allow Rate-1 and Rate-2 to be calibrated to specific engineering units.

Ratio: Six digits with selectable decimal point for tenths or hundredths.

Ratio Presentation: (Selectable) Rate-1/Rate-2, Rate-2/Rate-1, Rate-1-Rate-2/Rate-2, Rate-2-Rate-1/Rate-1. Displayed as percent.

Preset Counter: Six digits with programmable decimal point for tenths.

Preset Counter Presentation: Scaling factor allows calibration to specific engineering unit.

Preset Limits: Two limits, decimal point locations match preset counter.

Fault Reason Data: Seven pairs of registers for presentation of fault counts and elapsed times.

Fault Counts: Three digits, maximum count 199.

Fault Times: Four digits, decimal point at tenths. Capacity is 999.9 minutes.

Running Hours: Six digits, decimal point at tenths. Provides hours and tenths of total operating time to 99999.9.

2.5 DATA COMMUNICATIONS

The Series 7935 includes a RS-422 data communications feature that allows up to 32 units to be connected to a central computer via multi-drop five-conductor cable.

Complete details relative to wiring, communications protocol, and the use of this feature are provided in the Series 7935 Data Communications Applications Manual, No. 576013-222.

The data received and transmitted through the RS-422 port is fully representative of the information acquired by or entered in the Series 7935. It is suitable for connection to most personal computers or mainframes that are equipped with a serial communications port. It is not intended for use with simple data printer mechanisms.

It is strongly recommended that a skilled computer programmer and systems applications engineer be involved in the design of data systems incorporating the Series 7935.

Consult Veeder-Root for additional information relevant to the data communications capability of the product.

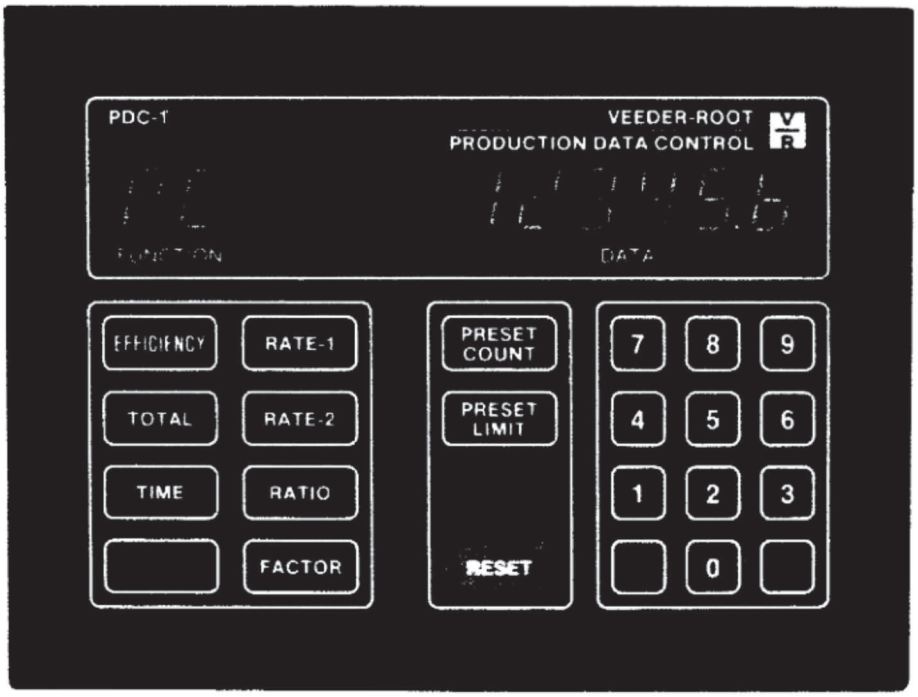
2.6 STANDARD MODELS

Description: Per preceding Specifications and Features.

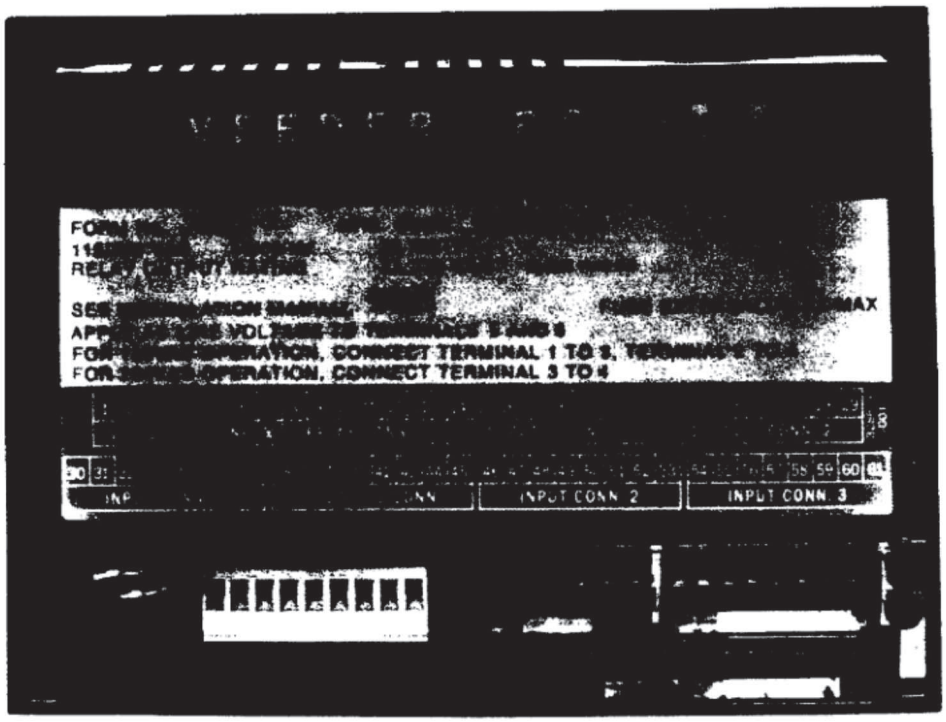
Form No.
793506-200

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2.7 FRONT PANEL FEATURES



2.8 REAR PANEL FEATURES



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SECTION 3.0 PREPARATION FOR INSTALLATION

It is recommended that the following steps be taken:

1. Check Package Contents. The shipping container for this unit should include:
   - 1 - Series 7935 Production Data Control
   - 4 -Mounting Hardware Assemblies
   - 1 - Panel Mounting Gasket
   - 1 - Installation, Operation and Programming Manual
2. Tools Required. No special tools are required to panel mount and wire the Series 7935. However, standard Phillips and slot head screwdrivers are needed.

WARNING: WHEN THE UNIT IS USED TO CONTROL A MACHINE OR PROCESS WHERE PERSONAL INJURY OR EQUIPMENT DAMAGE MIGHT OCCUR AS A RESULT OF FAILURE OF ANY ELECTRONIC OR OTHER FUNCTION, YOU ARE URGENTLY RECOMMENDED TO INSIST ON INSTALLATION OF SAFEGUARDS WHICH WOULD PROTECT THE OPERATOR AND/OR MACHINE IN THE EVENT OF ANY UNEXPECTED OPERATION OF THE MACHINE OR PROCESS.

3.1 OVERVIEW OF INSTALLATION AND PROGRAMMING PROCEDURES

For ease of understanding the procedures required to program, wire and install the Series 7935, it is recommended that the following sequence be followed:

1. **Choose the appropriate overall operating configuration.** Review the feature descriptions in Section 4.0, Determining Appropriate Operating Mode. Determine the features which are applicable to the desired use. Note the selected codes in the form provided.
2. **Program the function code entries.** Refer to the function code numbers for the features selected in the above step. Program the function codes in accordance with Section 5.1, Security Method Programming, and Section 5.2, General Function Code Programming.

Note: A temporary connection to an AC power supply (115 VAC/230 VAC, 50/60 Hz) must be provided for entry of function codes. Refer to Section 7.0, Installation and Wiring, for connections. No other connections should be provided at this stage. Remove power connection at completion of programming.

3. **Determine calibration factors affecting counting and rate functions.** Review Section 6.0, Calibration of Counting and Rate Features, calculate values of factors and enter the value.
4. **Install the unit in a suitable panel mount.** Refer to Section 7.0, Installation and Wiring.

Note: The gasket provided must be used to obtain dust/water tight front panel integrity.

5. **Provide AC power line connection.** Provide connection of 115 VAC or 230 VAC wiring per Section 7.0, Installation and Wiring. Note correct voltage selection wiring to avoid malfunction or damage. Provide recommended external fuse.

Note: Do not apply voltage or attempt to operate controlled system until installation is complete and initial start-up procedure has been implemented.

6. **Wire A and B input signal connections.** The Series 7935 is capable of accepting and processing several independent signals representing rate, time and/or count. Depending on the overall operating mode selected and programmed, a specific application requires a number of the signal inputs to be connected in a manner appropriate to the application. Refer to Section 7.0, Installation and Wiring, for wiring of inputs required to support the features used in your application. Use shielded wire on all inputs as instructed.
7. **Wire fault reason analysis inputs.** Seven inputs are provided for the Series 7935's unique fault reason analysis feature. These inputs may be connected per Section 7.0, Installation and Wiring, to sensors or contacts which detect specific faults or disruptions of the normal production process. Use shielded wire for all inputs.
8. **Wire remote reset command connections (optional to application).** The remote reset commands apply only to the preset counter function. If remote reset is required, wire per Section 7.0, Installation and Wiring.
9. **Wire security connections if required.** The Series 7935 is equipped with a choice of two systems for the protection of data in its nonvolatile memory:
   a. Digital code accessed via front panel buttons. This method **does not require** wired connections.
   b. External key-lock switch. Wire switch per Section 7.0, Installation and Wiring.
10. **Wire preset counter's control output(s) (optional by application).** The Series 7935 features two control output channels. Each channel is equipped with both a Form-C relay and an open-collector NPN transistor.

    A control output is activated in accordance with the preset count value that is entered in its associated limit. The specific method of control operation is based on the overall operating mode selected and programmed in accordance with this manual.

    Wire outputs per Section 7.0, Installation and Wiring. Use appropriate wire for the voltage and current associated with external load(s).
11. **Wire communication interface (if used).** Separate RS-422 data transmit and receive connections are provided. Wire per the Series 7935 Data Communications Applications Manual, No. 576013-222 (optional by application).
12. **Confirm proper display and/or control operations.** Refer to Section 8.0, Operation.

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SECTION 4.0 DETERMINING APPROPRIATE OPERATING MODE

The Series 7935 provides many useful features for industrial process information retrieval and control. Various models may not be equipped with all the features described in this manual. Carefully review Section 2.0, Specifications and Features, or the form number description addendum attachment (pink sheet), to determine the specific features of the model 7935 you have received.

4.1 FUNCTION CODES

Selective features are programmed by entry of special numerical values called function codes. The Series 7935 has a set-up programming mode with special registers that are used to store the codes which customize operations to best suit an application. The function codes and registers are identified by two-digit identification numbers: 00-99.

Function code values are always three-digit numbers referred to as "A B C" digits. For example, a function code value stated as 502 has "5" in the "A" digit position, "0" in the "B" digit position and "2" in the "C" digit position.

Examples: Digit Position

	Digital Position		
	A	B	C
Function Code = 502	5	0	2
Function Code = 115	1	1	5

In some instances the codes involve only selection of the "C" digit (with "A" and "B" digits considered invalid and always zero). In other instances only the "B" and "C" digits are selected (with the"A" digit always zero).

4.2 SELECTING FUNCTION CODE VALUES

The complete listing of function codes in this section should be reviewed before choosing the preferred feature variation controlled by each code. Each code MUST be considered in regard to its most appropriate variation — and a value written in the block provided.

IMPORTANT: WHEN DETERMINING VALUES FOR FUNCTION CODES, USE ONLY VALID NUMBERS AS PROVIDED IN THE LISTINGS.

4.2.1 Example of a Code Block

	A	B	C
Function Code 10 =			

In cases where only the "C" and/or "B" digits need to be written, the code blocks have zeros pre-printed:

	A	B	C
Function Code 11 =	0	0	

4.2.2 Programming Worksheet

Several copies of a worksheet have been provided. Use these to list the function code values for entry in Section 5.

4.3 ENTRY OF FUNCTION CODES

Section 5.0, Setup Mode Programming, and Section 6.0, Calibration of Counting and Rate Features, detail the procedure used to enter function code values into the Series 7935's memory.

Table 4-1. SUMMARY OF FUNCTION CODES

FC ID Number	Function	Applicable Features
00	Digital Security Code	Security
01	Security Method	Security
10	Home Display Position	Various
11	Shift Capacity	Total, Time, FRA
12	Preset Count Operation	Preset Counter, Outputs
13	Rate/Ratio Calculation	Rate-1, Rate-2, Ratio
14	Security Options	Totals, Preset, Shift Change
15	Time Options	Downtime, Uptime,
16	Communications Baud	RS-422 Data
17	Communications Address	RS-422 Data
18	Count Input Filtration	Input A, Input B
19	Transistor Output Configuration	Transistor Outputs
20	Output Time 1	Output 1
21	Output Time 2	Output 2
50	Scale Factor Mode	Universal Factor
51	Scale Factor Mode	Totals Factor
52	Scale Factor Mode	Preset Factor
53	Scale Factor Mode	Rate-1 Factor
54	Scale Factor Mode	Rate-2 Factor
55	Scale Factor Mode	Ratio Factor
60	Decimal Point Selection	Totals
61	Decimal Point Selection	Preset
62	Decimal Point Selection	Rate-1
63	Decimal Point Selection	Rate-2
64	Ratio Display Decimal Point	Ratio
70	Fault Condition Phase	Stop Input 1
71	Fault Condition Phase	Stop Input 2
72	Fault Condition Phase	Stop Input 3
73	Fault Condition Phase	Stop Input 4
74	Fault Condition Phase	Stop Input 5
75	Fault Condition Phase	Stop Input 6
76	Fault Condition Phase	Stop Input 7

Note: Codes 50 - 55 and 60 - 64 are entered per Section 6.0, Calibration of Counting and Rate Features.

Codes 16 - 17 apply only when RS 422 Communication Feature is used. Refer to separate manual (No. 576013-222).

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FUNCTION CODE 01 — SECURITY METHOD

Code 01, Digit C, allows you to choose from two security methods that guard program entries and reset functions:

DIGITAL CODE: Security via a three-digit customized code entry via the front panel keypad.

EXTERNAL SECURITY SWITCH: Connection of a key-lock switch to the rear wiring connector.

Note: Digit A and B are always zero.

	Digit A	Digit B	Digit C
Assignment:	Not used	Not used	Security Method
Value 0	Digit A and Digit B are always zero		External Switch Digital Code
1			
2-9	N/A	N/A	

Function Code 01 =

A	B	C
0	0	

FUNCTION CODE 00 — DIGITAL SECURITY CODE

Use only if Code 01 has specified "Digital Code Security". Code 00 is used to determine the customized three-digit security code required to authorize reset and programming functions. The code may be any value 000 to 999.

Function Code 00 =

A	B	C

FUNCTION CODE 10 — HOME DISPLAY POSITION AND AUTOMATIC HOME RETURN TIMER

The Code 10 "A" digit is used to select the home (default) display on the 7935. The Code 10 "B" and "C" digits work together to form a two-digit numerical value (01 second to 15 seconds) which is the time that an alternate function selection (made via the keypad) is displayed before an automatic return to the home display occurs.

	Digit A	Digit B	Digit C
Assignment:	Home display	B and C for two-digit time	
Value 0	Preset Count		
1	Rate-1		
2	Rate-2	B and C digits form an automatic return timer value 1 to 15 seconds. Example: B=1, C=2 sets time to 12 seconds.	
3	Ratio		
4	Grand Total		
5	Current Total		
6	Current Run Time		
7	Current Downtime		
8	Current Efficiency		

Function Code 10 =

A	B	C

FUNCTION CODE 11 — SHIFT CAPACITY

The Code 11 "C" digit selects the number of work shifts the Series 7935 will accommodate. Use of this code can eliminate the display of registers assigned to shift(s) not needed in the application. Digits "A" and "B" are always zero.

	Digit A	Digit B	Digit C
Assignment:	Not used	Not used	Number of Shifts
Value 0	A and B are always 0		N/A
1			1 Shift
2			2 Shift
3			3 Shift
4			4 Shift
5			5 Shift
6			N/A
7			N/A
8			N/A
9			N/A

Function Code 11 =

A	B	C
0	0	

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FUNCTION CODE 12 — PRESET COUNT OPERATION

Code 12 can be ignored if the preset counter is not required for an application. The "A" digit selects the preset counter control output(s) and automatic reset action.

The "B" digit selects the"forward" direction of the preset counter.

a. Reset to zero and count up to limits.

b. Reset to Limit 1 value, then count down to Limit 2 value and zero.

The "C" digit provides a choice: protection of the preset counter's front panel reset by a security system or reset allowed any time.

	Digit A	Digit B	Digit C
Assignment:	Output and Auto Reset	Forward Direction	Reset
Value			
0	Latch Relays	Down	Reset Security
1	Momentary*	Up	No Security
2-9	N/A	N/A	N/A

* Use Codes 20 and 21 to set momentary output time values. Automatic reset occurs at momentary output.

Function Code 12 =

A	B	C

FUNCTION CODE 13 — RATE/RATIO CALCULATION

Code 13 is used to customize the rate feature (and rate/ratio feature on models so equipped).

Digit "A" selects the method of ratio calculation:

$$\text{Ratio} = \text{Rate-1/Rate-2}$$

or

$$\text{Ratio} = \frac{\text{(Rate-1 - Rate-2)}}{\text{Rate-2}}$$

Digit "B" selects the rate display in units per minute or units per hour.

Digit "C" provides a choice of direct ratio calculation (per Digit "A" description) or transposing Rate-1 and Rate-2 in the calculation.

	Digit A	Digit B	Digit C
Assignment:	Ratio Calculation	Rate Mode	Ratio Mode
Value			
0	R1 / R2	Rate per minute	Direct
1	(R1 - R2) / R2	Rate per hour	Inverted
2-9	N/A	N/A	N/A

Function Code 13 =

A	B	C

FUNCTION CODE 14 — SECURITY OPTIONS

Code 14 provides programming flexibility for three important keyboard features. You can choose to:

a. Reset the shift totals via the front panel button anytime or restrict reset with the 7935's security system.

b. Change the current shift via the front panel controls anytime or restrict change with the 7935's security system.

c. Change the preset counter limits via the front panel controls or restrict change with the 7935's security system.

	Digit A	Digit B	Digit C
Assignment:	Totals Reset	Shift Change	Limits
Value			
0	Security	Security	Security
1	Unrestricted	Unrestricted	Unrestricted
2-9	N/A	N/A	N/A

Function Code 14 =

A	B	C

FUNCTION CODE 15 — TIME OPTIONS

Code 15 provides the choice of shift down time display or shift up time display when the TIME key is pressed.

	Digit A	Digit B	Digit C
Assignment:	None	None	Shift Time
Value			
0	Digit A and Digit B are always zero		Down Time
1			Up Time
2-9	N/A	N/A	N/A

Function Code 15 =

A	B	C
0	0	

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FUNCTION CODE 18 — COUNT INPUT FILTRATION

The Code 18 "C" digit selects the filtration characteristics of the primary signal input. The "B" digit applies to the secondary signal input. The "A" digit is not used and should be set at zero.

The primary (Input-A) and secondary (Input-B) signal inputs have separate programmable filters affecting speed response. When selecting the value of Code 18, the maximum pulse rates expected for the primary and secondary inputs must be determined.

If the input is from contact closure or less than 40 Hz, use the low speed filtration. If the input pulse rate is greater than 40 Hz, use the high speed filtration.

	Digit A	Digit B	Digit C
Assignment:	None	Secondary Input	Primary Input
Value 0 1 2-9	Digit A is always zero	High Speed Low Speed N/A	High Speed Low Speed N/A

Function Code 18 =

A	B	C
0		

FUNCTION CODE 19 — TRANSISTOR OUTPUT CONFIGURATION

Code 19 selects the normal status of the two transistor outputs associated with the preset counter feature. Choice is allowed for "normally on" or "normally off" status. This code may be ignored if solid-state outputs are not used in the application.

	Digit A	Digit B	Digit C
Assignment:	None	Limit 2 Output	Limit 1 Output
Value 0 1 2-9	Digit A is always zero N/A	Normally Off Normally On N/A	Normally Off Normally On N/A

Function Code 19 =

A	B	C
0		

FUNCTION CODE 20 AND 21 — PRESET COUNTER MOMENTARY OUTPUT TIMERS (Used in conjunction with Function Code 12)

Use Codes 20 and 21 only if the Code 12 Digit A has a value of 1. Code 20 sets the momentary hold time of output 1; Code 21 sets output 2.

The time can be set over a range of 0.05 seconds to 12.75 seconds, in 0.05 second steps. Determine the value of Code 20 or 21 using the desired hold time within a range of 0.05 to 12.75 seconds to the closest 0.05 second in the following formula:

$$\frac{\text{Desired Hold Time}}{0.05} = \text{Code}$$

For example, if the desired time is 4.5 seconds:

$$\frac{4.50}{0.05} = 90$$

The code would be "090".

Note: Code values "000" or greater than "255" are invalid.

Function Code 20 = (Output-1)

A	B	C

Function Code 21 = (Output-2)

A	B	C

FUNCTION CODES 50 - 55 — SCALE FACTOR MODE

Codes 50 to 55 select the operating characteristics of the scale factor registers. The choice of entry for these function codes is dependent on the procedure in Section 6.0, Calibration of Counting and Rate Features.

Digit A is used to inhibit access to the scale factor by the front panel factor key. If a particular factor is inhibited, it will not appear in the display when the FACTOR Key is pressed.

Digit B is used to place the Universal Factor in series with the other factor(s).

Digit C is used to select multiplication or division mathematics.

Refer to Section 6

	Digit A	Digit B	Digit C
Assignment:	Inhibit	Universal Factor	Mathematics
Value 0 1 2-9	No Yes N/A	Out In N/A	Divide Multiply N/A

Function Code	Factor	Digit A	Digit B	Digit C
50	F1			
51	F2			
52	F3			
53	F4			
54	F5			
55	F6			

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FUNCTION CODES 60 - 63 — DECIMAL POINT SELECTION

Codes 60 to 63 are used to illuminate the decimal point at the tenths position of the following display functions:

Code	Function
60	Shift Totals
61	Preset Count
62	Rate-A
63	Rate-B

	Digit A	Digit B	Digit C
Assignment:	None	None	Decimal Point
Value 0	Digit A and Digit B are always zero		No Decimal
1			Tenths
2-9	N/A	N/A	N/A

	A	B	C
Function Code 60 =	0	0	

	A	B	C
Function Code 61 =	0	0	

	A	B	C
Function Code 62 =	0	0	

	A	B	C
Function Code 63 =	0	0	

FUNCTION CODE 64 — RATIO DISPLAY DECIMAL POINT

Code 64 is used to position the ratio display decimal point at the tenths or hundredths position.

	Digit A	Digit B	Digit C
Assignment:	None	None	Decimal Point
Value 0	Digit A and Digit B are always zero		Tenths
1			Hundredths
2-9	N/A	N/A	N/A

	A	B	C
Function Code 64 =	0	0	

FUNCTION CODES 70 - 76 — FAULT CONDITION PHASE

Codes 70 to 76 are used to define the "normal" condition for the seven fault inputs. The "normal" condition is defined as the input status that exists when the monitored fault is not present; i.e., downtime is not accumulated. For example, if a closed contact is provided for indicating the absence of a fault, the normal condition is "closed."

Note: If this feature is not to be used in the application, program Codes 70 to 76 to "open" as the normal condition.

	Digit A	Digit B	Digit C
Assignment:	None	None	Stop Reason Normal Condition
Value 0	N/A	N/A	Closed
1	N/A	N/A	Open
2-9	N/A	N/A	N/A

	A	B	C
Function Code 70 = Fault Input-1	0	0	

	A	B	C
Function Code 71 = Fault Input-2	0	0	

	A	B	C
Function Code 72 = Fault Input-3	0	0	

	A	B	C
Function Code 73 = Fault Input-4	0	0	

	A	B	C
Function Code 74 = Fault Input-5	0	0	

	A	B	C
Function Code 75 = Fault Input-6	0	0	

	A	B	C
Function Code 76 = Fault Input-7	0	0	

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SECTION 5.0 SETUP MODE PROGRAMMING

5.1 SECURITY METHOD PROGRAMMING

There are two possible methods to ensure security of resettable functions and program entries. Choose one of the following:

a. **Digital Code.** This security feature is "unlocked" by user entry of a three-digit code via the front panel numerical keypad.

b. **External Switch.** An input is provided that can be used with a key-lock type switch.

Two function codes must be considered when choosing the desired method. These codes must be programmed before the entry of other function codes.

FUNCTION CODE 01: Selects the security method.

FUNCTION CODE 00: Selects a customized code if the digital security method is used. This code should be disregarded when the external switch security method is used.

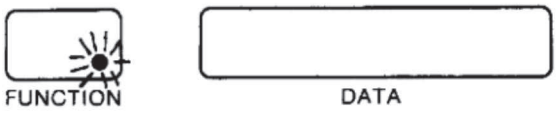
Determine your choice of security method (digital code or external switch).

5.1.1 Wire the Rear Connector for Setup Procedure

a. Connect a temporary jumper wire between terminals 35 and 36 at the rear of the 7935.

b. Provide temporary AC power and voltage selection wiring per Section 7.0, Installation and Wiring. Apply power.

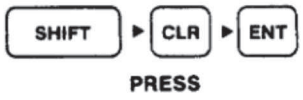
c. Note that the right-hand decimal point of the function display has illuminated as shown below. This confirms that security has been unlocked in order to allow completion of the programming procedure.



Note: If the display response described above does not occur, turn off AC power and check the connections per steps a and b. Reapply AC power and proceed from step c.

5.1.2 Select Setup Mode

a. Press the following keys in rapid succession:



b. Observe that the function display shows F C (Function Code) and the data display shows two dashes as shown below. This indicates that the 7935 is in the setup mode and its program memory is ready for entry.

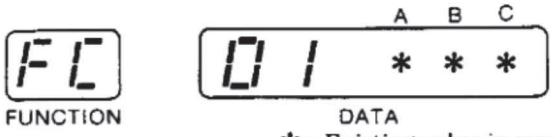


Note: If the display presentation does not appear, it is possible that buttons were not pressed in rapid succession. In this case, repeat steps a and b.

5.1.3 Enter Value of Function Code 01 (Security Method Selection)

a. Bring Function Code 01 to the display by pressing the two-digit identification number:





✱ = Existing value in memory.

b. Clear the existing value.



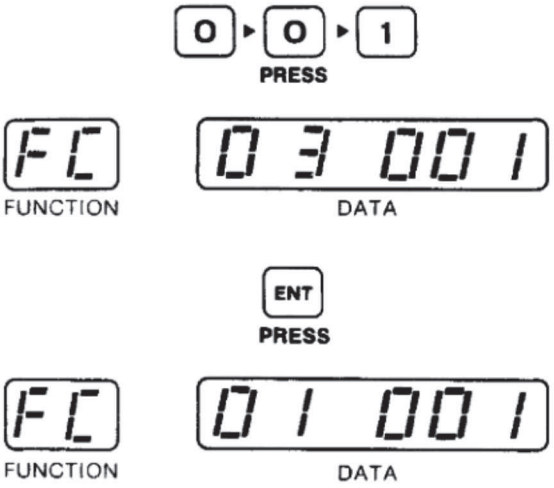


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c. Enter the value for Code 01 that was determined in Section 4.0, Determining Appropriate Operating Mode.

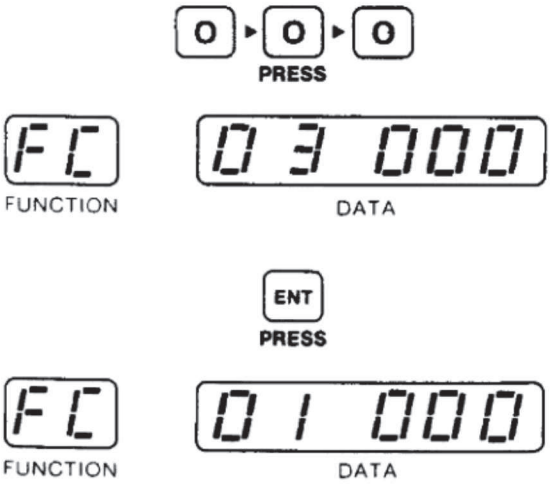
Review: a. Choice of Digital Code Method = 0 0 1
b. Choice of External Switch Method = 0 0 0

Example: If Code 001 (digital code method) is chosen:



Note: The entry function is confirmed by a single blink of the display.

Example: If Code 000 (external switch method) is chosen:



Note: The entry function is confirmed by a single blink of the display.

IMPORTANT: IF THE EXTERNAL SWITCH METHOD OF SECURITY WAS SELECTED, SKIP SECTION 5.1.4 AND PROCEED TO SECTION 5.1.5.

5.1.4 Enter Value of Function Code 00 (Digital Security Code Number)

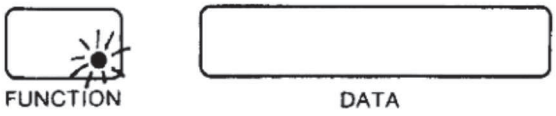
IMPORTANT: TURN OFF AC POWER AND REMOVE THE JUMPER WIRE PREVIOUSLY INSTALLED BETWEEN TERMINALS 35 and 36.

a. Restore AC power.

b. Test the digital code security method by using the factory set security code number "0 0 0".



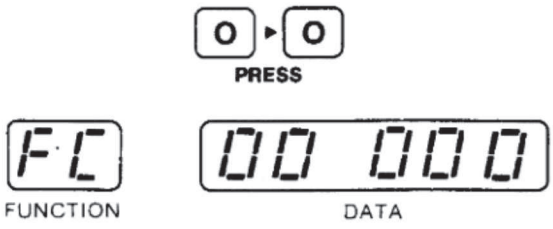
c. Observe that the function display shows an illuminated decimal point to confirm that security is unlocked.



d. Return to the setup mode by performing the steps in Section 5.1.2, Select Setup Mode.

Note: The setup mode can only be accessed when security is unlocked. Since security was unlocked in step c, it is important to perform step d quickly since security automatically relocks in ten seconds if no additional keyboard activities are performed (indicated by the function display decimal point going out). Should this occur, repeat step b and immediately perform step d.

e. Bring Function Code 00 to the display.

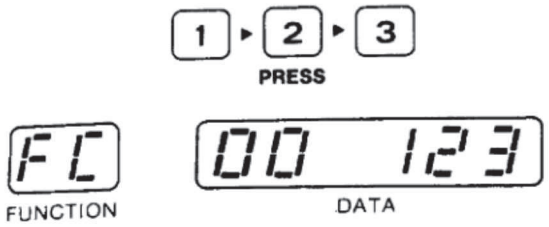


f. Clear the factory-set security code even if already at zero:

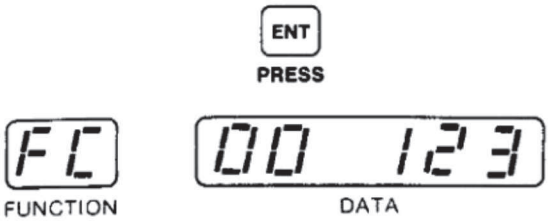


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g. Press the three-digit number you have chosen as the customized security code (i.e., 1 2 3).

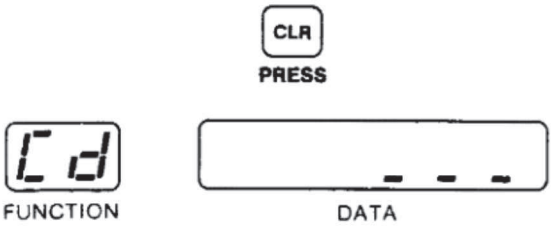


h. Enter the code in memory.

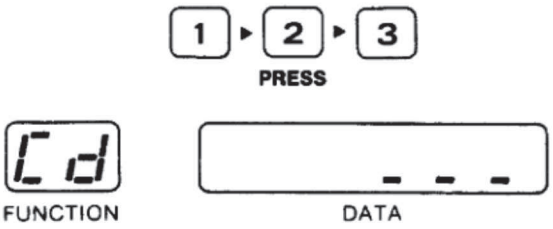


Your customized security code number is now the only value that will be accepted by the Series 7935 for unlocking security protection of resets and other protected functions.

i. Test the response to your customized security code number by performing the following steps:
   1. Exit from the setup mode by pressing the RESET key.
   2. Press the CLR key.

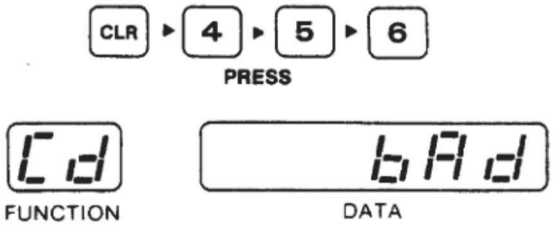


   3. Press your customized security code number (i.e., 1 2 3).



Note: The bars in the display change levels to indicate keypad depressions. The actual number is not displayed to avoid observation by unauthorized persons.

   4. Observe that the decimal point in the function display illuminates at the completion of the security code number entry. Observe that the unit automatically returns to locked security when the decimal point goes out after ten seconds.
   5. Enter an incorrect security code (i.e., 4 5 6).



Note: The display indicates "BAD" to signify rejection of an incorrect code.

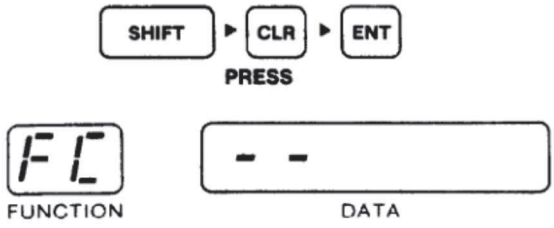
j. Should you lose or misplace your customized security code number, perform the following steps:
   1. Turn off power and connect a jumper wire between terminals 35 and 36.
   2. Restore power momentarily.
   3. Turn off power and remove the jumper wire.
   4. Restore power.
   5. The factory-set security code (0 0 0) is now in effect. You may enter a new value for a customized security code number by performing the procedure outlined in Section 5.1.2, Select Setup Mode, and Section 5.1.4, Enter Value of Function Code 00 (Digital Security Code Number).

5.1.5 Preparing to Complete Remaining Function Code Programming Procedures

a. If the external switch security method was selected, the jumper wire connection between terminals 35 and 36 should be retained until completion of programming.

b. If the digital code security method was selected, it is important NOT to have a jumper connection between terminals 35 and 36. If you find that the jumper is installed, it is necessary to repeat the procedure detailed in **Section 5.1.4, Enter Value of Function Code 00 (Digital Security Code Number).**

c. Observe that the unit is in the setup mode by confirming that "FC" is in the function display. If it is not present, perform the following steps:
   1. If the digital code security method was selected, unlock security by pressing the **CLR** key and your customized number.
   2. Access the setup mode by pressing:



   3) Proceed to Section 5.2, General Function Code Programming.

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5.2 GENERAL FUNCTION CODE PROGRAMMING

Review the function code values you selected by evaluating the operating variations described in Section 4.0, Determining Appropriate Operating Mode.

5.2.1 Accessing the Setup Mode

Unlock security by using the selected method (digital code or external switch) and access the setup mode by pressing:



5.2.2 Enter Function Code Program

IMPORTANT: IN GENERAL, FUNCTION CODES MAY BE ENTERED IN ANY ORDER. HOWEVER, FUNCTION CODES 01 AND 00 MUST BE ENTERED FIRST AS DETAILED IN SECTION 5.1, SECURITY METHOD PROGRAMMING.

The following steps are required to enter the codes developed in Section 4.0, Determining Appropriate Operating Mode, into the Series 7935's program memory.

a. Note the value of the first function code. For example:

Function Code 10 =

A	B	C
1	0	5

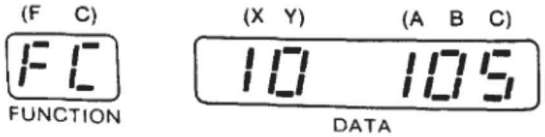
b. Access the code register (i.e., register number 10):





✱ = Existing value in memory.

c. The display presentation provided in the function code programming mode is as follows (i.e., register number 10, value of 105):

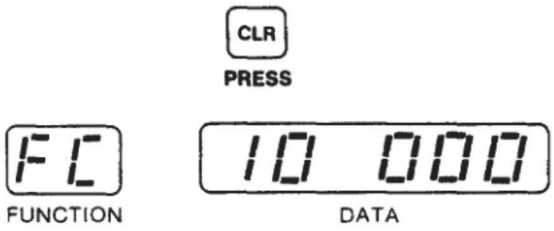


FC: The function display retains the characters "FC" while the Series 7935 is in the setup mode.

XY: Two digits used to identify the function code register number accessed.

ABC: Three digits representing the value of the function code.

d. Clear the existing code in memory:

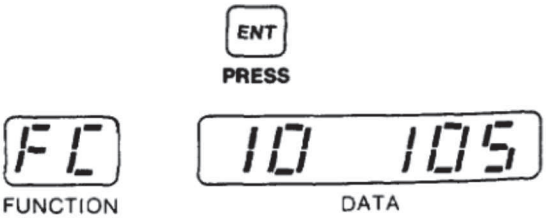


e. Press the numerical value keys for the desired "A B C" code values (i.e., 105):



Note: If an error was made, repeat steps d and e. If the wrong function code was accessed, press the FACTOR key and return to step a.

f. Confirm the proper value is on the display then press:



g. Note the value of the next function code developed in Section 4.0, Determining Appropriate Operating Mode.

h. Repeat steps b through g until all codes have been entered.

i. Confirm that code entries are correct by pressing the two-digit identification numbers for all codes developed in Section 4.0, Determining Appropriate Operating Mode, and checking for correct "A B C" digit values.

Note: If a serial communications port is used in the application, refer to the Series 7935 Data Communications Applications Manual, No. 576013-222, for development and entry of the additional codes relevant to communications.

j. Proceed to Section 6.0, Calibration of Counting and Rate Features.

5.2.3 Exiting the Setup Mode

Exit the setup mode by either pressing the RESET key or removing the AC power supply.

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