OPERATOR'S MANUAL

CM900
AutoID Interface Module

Manual Revision 5, 3-01
Publication #17-1122

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1 GETTING STARTED

1.1 Introduction

Escort Memory Systems' CM900 AutoID Interface Module is an advanced peripheral for the Modicon 984 Compact PLC rack. The CM900 expands a host PLC's data collection and dissemination capabilities by providing an RFID antenna port and serial communication facilities. A standard application program is included with each unit. The standard program requires that a custom loadable — Escort Memory Systems' SP1004 software program — be loaded on the host PLC. For custom programming, the SP1011 C Language Development Package with custom libraries, is available. The Franklin Compiler required for CM900 Software development must be order separately, EMS part number 88-1001.

The CM900's fully-buffered, bi-directional serial communications port is configurable to support RS232 and RS422 communications formats. It can be set to communicate with a wide variety of devices, via selectable baud rate, parity, and number of data bits and stop bits. A dedicated RS232 port is also provided for programming and debugging.

The RFID antenna port is compatible with Escort Memory Systems's industry-leading EMS® Read/Write RFID components. The communications connection between the CM900 and antenna is via two twisted pair wires (four wires) with a maximum cable length of 1,200 meters (4,000 ft).

The CM900 also features 32K bytes of nonvolatile EEPROM program storage as well as 32K bytes of system RAM. Seven status LEDs mounted on the front of the CM900 greatly assist program debugging and maintenance.

1.2 Unpacking and Inspection

Unpack the CM900 and retain the original shipping carton and packing material in case any item has to be returned to Escort Memory Systems. Inspect each item carefully for evidence of damage. If any item appears to be damaged, notify Escort Memory Systems immediately. Check that all of the following items are present:

- CM900 AutoID Module
- Operator's Manual
- Standard Program Diskette

1.3 Organization of This Manual

This manual presents in Chapters 2, 3, and 4 the essential information required for installing, connecting and powering the CM900. The following chapters explain the configuration and operation of the CM900.

2 MECHANICAL SPECIFICATIONS

2.1 Dimensions

Figures 1 and 2 show the overall dimensions of the CM900 module. The enclosure is identical to that of other 984 Compact components.

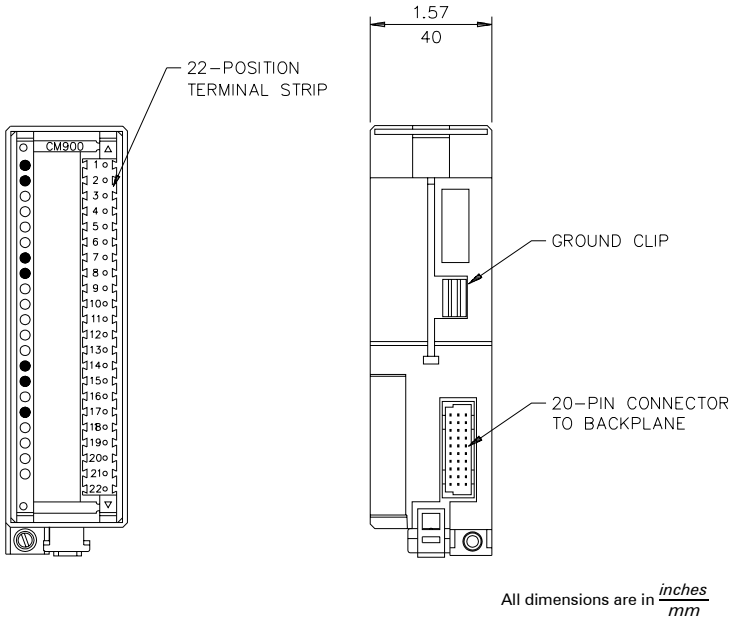

Figure 1 — CM900 Front and Rear Views

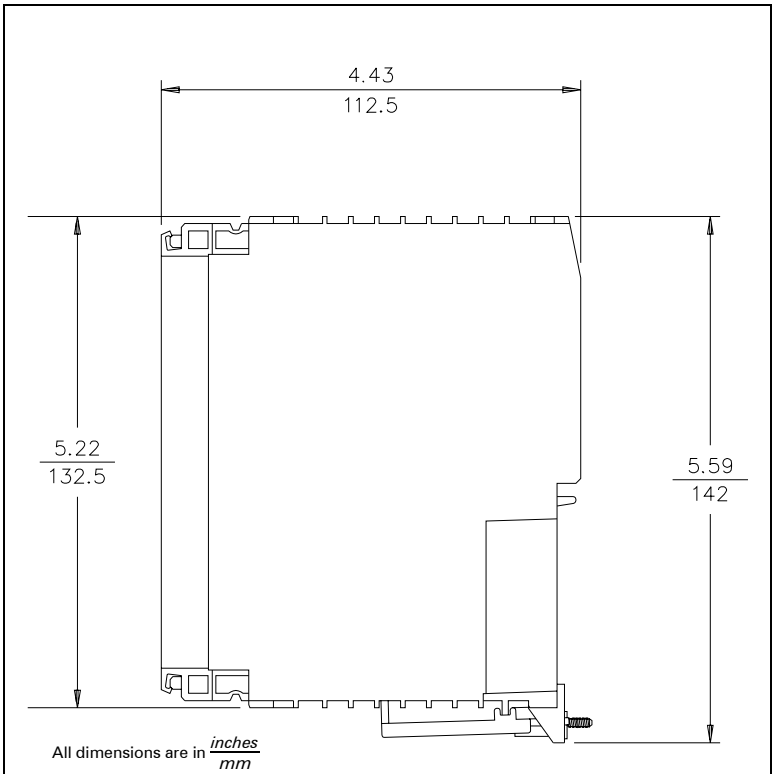

Figure 2 — CM900 Side View

2.2 Mounting the CM900

WARNING!
Turn power to the PLC rack and CM900 OFF before installing or removing the CM900.

The CM900 can be inserted into the Modicon 984 Compact Rack at any location. Hook the top of the CM900 enclosure to the hook provided on the rack and press in the unit completely to ensure good contact with the backplane. Secure the unit by tightening the slotted screw at the bottom of the enclosure.

3 POWER AND ELECTRICAL INTERFACE

3.1 22-Position Connector

Connections between the CM900 and the front-end external power supply, serial ports, and EMS remote RFID antenna are via a 22-position connector for terminal strips located on the front of the unit as shown in Figure 3. Two 11-position mating terminal strips are supplied with the unit. Table 1 shows the pinouts for the 22-position connector.

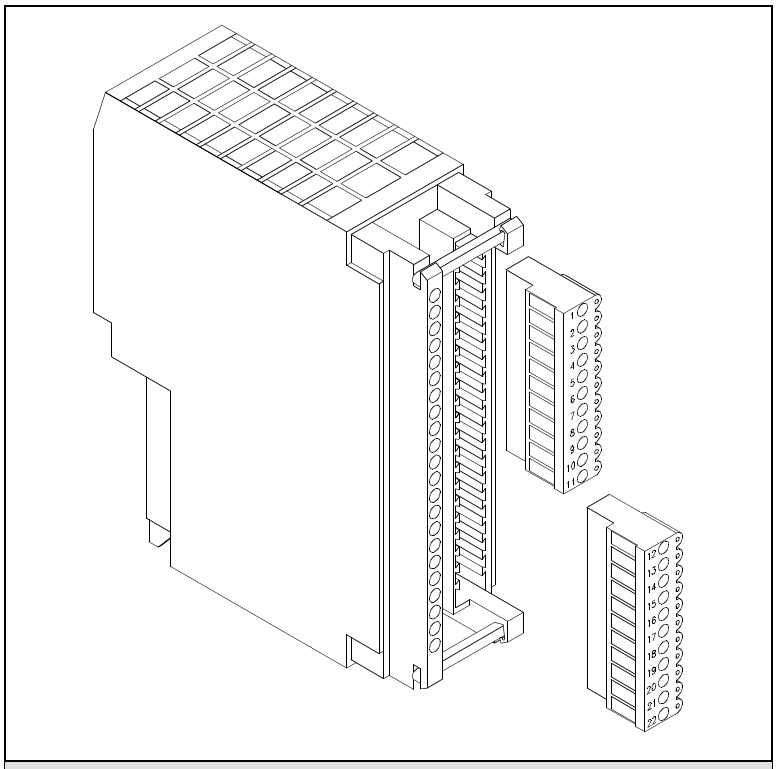

Figure 3 — CM900 Connectors

Table 1 - RFID Port/Power Connector Pinouts

Pin	Function	Pin	Function
1	+24 VDC	12	+24 VDC
2	+24 VDC	13	+24 VDC
3	COM1 RS422 RX+	14	COM2 RS232 RX (Programming Port)
4	COM1 RS422 RX-	15	COM2 RS232 TX (Programming Port)
5	COM1 RS422 TX+	16	COM2 Signal Ground (Programming Port)
6	COM1 RS422 TX-	17	Antenna, Pin 1
7	COM1 RS232 RX	18	Antenna, Pin 2
8	COM1 RS232 TX	19	Antenna, Pin 3
9	COM1 RS232 GND	20	Antenna, Pin 4
10	No Connection	21	Ground
11	Ground	22	Ground

3.2 Indicators

Seven LEDs are mounted on the front of the CM900 module for status indication as shown in Figure 4. The LEDs function as follows:

POWER	—	GREEN when CM900 is fully powered.
ERROR	—	RED when CM900 has faulted.
COM1 RX	—	GREEN when receiving on COM1.
COM1 TX	—	GREEN when transmitting on COM1.
COM2 RX	—	GREEN when receiving on COM2.
COM2 TX	—	GREEN when transmitting on COM2.
ANT	—	YELLOW when the antenna is active.

NOTE:
If all serial communication LEDs are on, the CM900 is not connected to 24 VDC power. Refer to Section 3.3 for power connections and specifications.

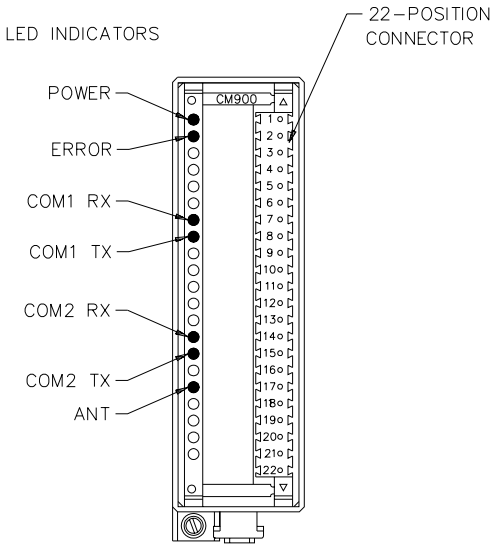

Figure 4 — CM900 LEDs and Connector

3.3 Power Requirements

The CM900 backplane is powered directly from the Modicon 984 Compact rack +5VDC supply. The front end must be powered from a user-supplied power supply according to the following specifications:

Supply Voltage	—	24 VDC, +/- 15%
Min. Current	—	250 mA (750 mA with antenna)
Max. Ripple	—	2% of DC voltage

The power supply connects to the two eleven-position terminal strips as shown in the pinout listing in Table 1.

EMS recommends the following power supply, or an equivalent:

Panasonic Switching Series ETU-24K13
24 VDC at 1.3 Amps Max.
Closed Frame
FCC Class B radiated noise
Ripple 1% of output
Load regulation to within 0.8%, 0-100% of rated current

If the RFID port is being used, the RFID antenna may also be powered from the same power supply by connecting to the spare power and ground pins on the terminal strips as given in the pinout. If you are powering the RF antenna from the same power supply, a supply capable of 750 mA will be required.

Alternatively, the RFID antenna may be powered from a local 24 VDC supply. Voltages between the antennas and the CM900 must conform to RS485 limits; however, it is usually not necessary to maintain a common ground with the CM900 module. See your specific RFID antenna manual or instruction sheet for power and ground pinouts.

3.4 RS232 Serial Interface

The connections for the RS232 interface are RS232 TX (data *from* the CM900), RS232 RX (data *to* the CM900), and Signal Ground, as shown in Figure 5.

The signals and electrical loads from the RS232 TX and RS232 RX pins should conform to the electrical specifications of EIA Standard RS232. The maximum cable length specified under this standard is 50 feet. High quality shielded cable should be used for these connections.

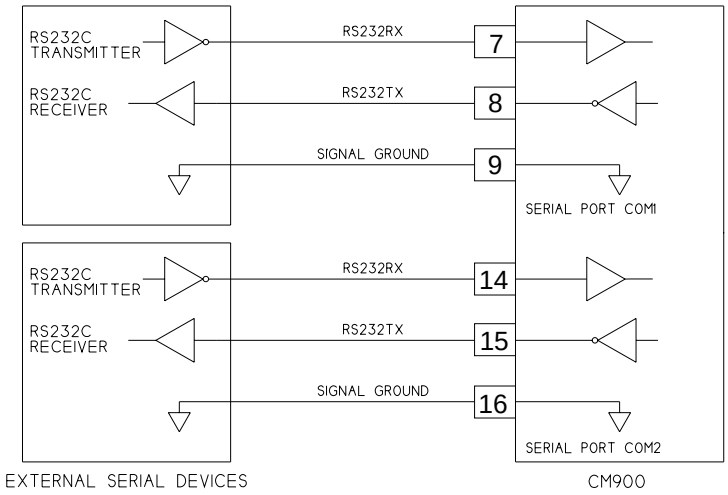

Figure 5 — RS232 Connections

Both COM1 and COM2 can be configured for RS232 serial communications.

3.5 RS422 Serial Interface

RS422 is recommended for electrically noisy environments. The connections are RS422 TX+ and RS422 TX- (data *from* the CM900) and RS422 RX+ and RS422 RX- (data *to* the CM900), as shown in Figure 6.

For maximum margin at very long line lengths (over 1000 feet), a ¼ watt, 180 ohm terminating resistor should be provided by the user across the RS422 RX+ and RS422 RX- lines at the CM900, and across the RS422 TX+ and RS422 TX- lines at the device being connected.

The signals and electrical loads on the pins, as well as the characteristics of the shielded twisted pair cable must conform to the electrical specifications of EIA Standard RS422. The maximum recommended length of an RS422 connection is 4000 feet. High quality shielded cable should be used for these connections.

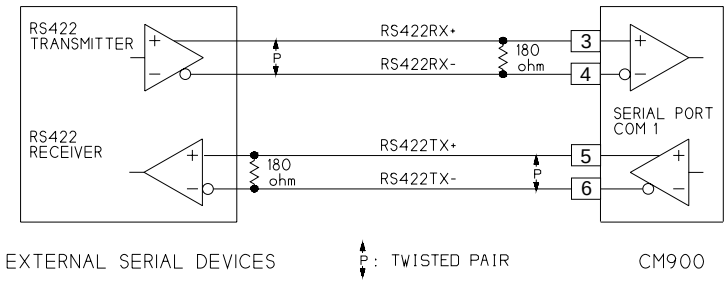

Figure 6 — RS422 Connections

Please note that only COM1 supports RS422 serial communications.

3.6 RFID Port Interface

Connections to a EMS Read/Write RF antenna are shown in Figure 7. High quality shielded cable (such as Belden 9829 with two wire pairs or Belden 9830 with three pairs) should be used for this connection. The cable shield should be connected to ground at one end only. See your specific antenna manual or instruction sheet for antenna pinouts.

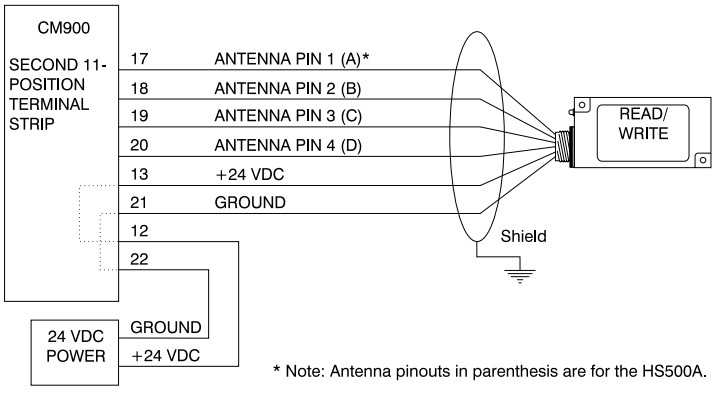

Figure 7 - Connections to Datalogic Antenna

4 TECHNICAL OVERVIEW

4.1 Standard Program & Custom Loadable

The CM900 Standard Program supplied with the unit allows the CM900 to perform register transfers to and from the host PLC, manages transfers of up to 100 registers, examines the command register for commands, and executes appropriate tasks. In order to function, the Standard Program requires that the SP1004 Loadable from EMS be installed on the PLC. The custom software loadable can also be used as a starting point when writing custom software.

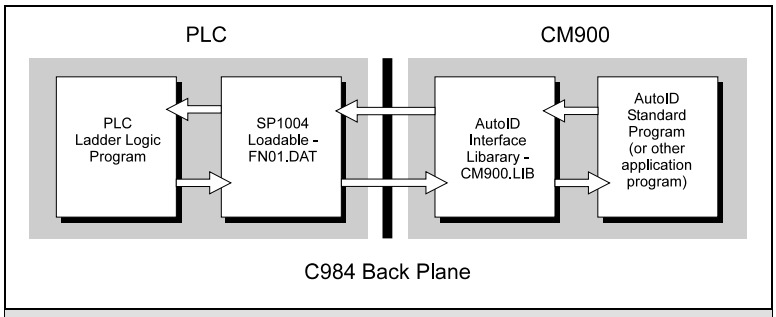

Figure 8 — CM900 and PLC Information Flow

Included on the CM900 Standard Program diskette is a file containing the personality for the CM900 (DL.DAT). The personality is essential to installing the CM900 whether or not you intend to use the SP1004 Loadable or the CM900 Standard Program. See section 5.2 for more information on the CM900 personality.

4.2 C Language Development Package

In the event that the user needs different functionality than is provided by the Standard Program, EMS offers the SP1011 C Language Development Package to allow the development of custom C-language application programs. The SP1011 includes source code for the Standard Program, Franklin 8051 Development Tools (Compiler, Assembler, Linker, Librarian, Object-to-HEX file converter), the CM900.LIB custom interface library, and appropriate header files and download utilities.

5 CM900 STANDARD PROGRAM

5.1 Introduction

EMS's CM900 offers the user an unprecedented degree of flexibility in data gathering through its C-programming option. Although this is a key feature, many PLC users will neither want nor need to program the CM900 themselves. It was for this reason that the Standard Application program was developed.

The Standard Application Program allows the user to read and write from the CM900's serial and RFID ports entirely from within the PLC programming environment. In doing so it performs the following tasks:

1) Effects register transfers to and from the PLC via the Compact backplane
2) Manages up to 100 register transfers
3) Scans incoming registers for commands and executes appropriate tasks

The Standard Program utilizes a simple command set protocol to communicate back and forth with the PLC. This manual outlines that protocol and provides examples in order to aid the new user in PLC program development.

5.2 Configuring the PLC

Before attempting to run the CM900 you must download the SP1004 Loadable and the CM900 personality, modify the GCNFA120.SYS file and traffic-cop the CM900 for 6-register bi-directional binary transfers.

CM900 Personality

The CM900's personality must be downloaded to the PLC before it can be traffic-copped. The personality can be found on the standard program diskette supplied with the CM900 under the file name DL.DAT. For help in downloading the personality, refer to the appropriate Modicon manual.

Modifying the GCNFA120.SYS File

The CM900's personality must be listed in the GCNFA120.SYS file for it to be recognized by the PLC. Using a standard text editor, add the following line to the list of personalities in the GCNFA120.SYS file:

CM900 , 119 , 0 , 12 , 12 , AUTOID INTERFACE, 0,

Traffic-Copping

Traffic-cop the CM900 for 6-register bi-directional binary transfers. Once the CM900 has been traffic-copped, connections between all components have been properly made, and power is applied, the unit will be ready to accept commands from the PLC. The CM900 accepts new programs through its RS232 programming/debug port (COM2). See the *SP1011 Software Manual* for details on developing and downloading custom C programs.

5.3 Communication Overview

Data is passed back and forth between the CM900 Standard Program and the PLC via the SP1004 Loadable (function block) in blocks of 1 to 100 registers, In the following text **Send Data** is defined as passing a command from the PLC to the CM900 (PLC ⇒ CM900), and **Receive Data** as the response from the CM900 to the PLC (CM900 ⇒ PLC). The upper byte of the first register passed to the CM900 is commonly used as a port designator, while the lower byte is reserved for commands. The following example illustrates this base register transfer format.

Command from PLC

MSB	**LSB**
(Port Address)	(Command #)
(Data) . .	(Data) . .
Message Terminator	Message Terminator

Response from CM900

MSB	**LSB**
(Echo Port Address)	(Echo Command #)
(Data) . .	(Data) . .
Message Terminator	Message Terminator

When the command is sent successfully the CM900 will echo the port address and command. If the command encounters an error the CM900 will echo the port address but will return FFH in the LSB instead of echoing the command. Should this occur, check that all connections have been properly made.

The CM900 Standard Program will also pass an error code in the second register passed to the PLC. For a list of the error codes and explanation, please refer to Section 5.7 on page 38.

Error response from CM900

MSB	**LSB**
(Echo Port Address)	FFH
ERROR CODE	
FFH	FFH

5.4 Port Addressing

The CM900 has one RFID and two serial communication ports. The CM900 Standard Program protocol assigns each port a unique number which is used by the PLC to direct read and write requests. Table 2 provides a complete listing of these numbers, which are encoded in the most significant byte (MSB) of the first register passed to the module in the predefined command set.

Table 2 - Standard Program Port Assignments

PORT NAME	PORT ADDRESS	DESCRIPTION
ANT	00 Hex	RFID Port Antenna
COM1	01 Hex	Serial Port COM1
COM2	02 Hex	Serial Port COM2

5.5 Command Set Overview

The Standard Program recognizes a variety of commands from the PLC for performing reads and writes to the CM900's ports. The commands are encoded in the least significant byte (LSB) of the first register passed to the CM900 from the PLC. Table 3 lists each command and provides a brief description of its function.

Table 3 - Command Set Listing

COMMAND	HEX EQUIVALENT	COMMAND NAME
DIRECT RF		
0	00 Hex	Idle
1	01 Hex	RF Port Noncontiguous Read
2	02 Hex	RF Port Noncontiguous Write
3	03 Hex	RF Port Configure Noncontiguous Read/Write Addresses
4	04 Hex	RF Port Fill Tag
5	05 Hex	RF Port Block Read
6	06 Hex	RF Port Block Write
SERIAL		
10	10 Hex	Serial Port Configure
11	11 Hex	Serial Port Block Read
12	12 Hex	Serial Port Block Write
13	13 Hex	Clear Serial Port
POSTED RF		
20	20 Hex	Posted Block Write*
21	21 Hex	Posted Block Read*
22	22 Hex	Read Posted Read Data Buffer *
23	23 Hex	Posted Status Byte*
24	24 Hex	Cancel Posted Operations*

*Use of Posted Commands requires special considerations. Please consult EMS or your distributor before implementing these commands.

5.6 Command Descriptions

Command 0 (00 Hex): Idle

DESCRIPTION
Sets the command byte to 0.

DISCUSSION
When a file move has been completed or when RF operations are not needed, the command byte may be set to zero, but this is not required. Alternatively, the new command can overwrite the old command values. Unlike other commands, the CM900 will not respond to the idle command.

EXAMPLE
Sets the command byte to 0.

Command from PLC

MSB	LSB	Remarks
00H	00H	ANT, perform Command 0
FFH	FFH	Message Terminator

Response from CM900

None

Command 1 (01 Hex): RF Port Noncontiguous Read

DESCRIPTION
Directs an RFID antenna to perform a Read of noncontiguous data addresses in an RFID tag.

DISCUSSION
This command is designed to perform noncontiguous address reads from an RFID tag. The data collected from the tag is presented to the PLC through a backplane register transfer. Before a noncontiguous read command can be performed, the addresses must be preconfigured though the use of the configuration command (Command 03). The data will be read in the same sequence as the addresses are originally stored. The data read from the tag is returned in the LSB of the register and the MSB is always 00H.

EXAMPLE
The following example illustrates a noncontiguous read command issued after the addresses are preconfigured using the example presented with the configuration command (Command 03). It directs the antenna to read and return the data at addresses 0005H, 0100H, 0101H, 04AAH, and 0597H of the tag memory.

Command from PLC

MSB	LSB	Remarks
00H	01H	ANT port, perform Command 1
FFH	FFH	Message Terminator

Response from CM900

MSB	LSB	Remarks
00H	01H	Port echo, Command echo
00H	10H	Data read at Address 0005H
00H	11H	Data read at Address 0100H
00H	AAH	Data read at Address 0101H
00H	BAH	Data read at Address 04AAH
00H	32H	Data read at Address 0597H
FFH	FFH	Message Terminator

Command 2 (02 Hex): RF Port Noncontiguous Write

DESCRIPTION
Directs the RFID antenna to perform a Write to noncontiguous data addresses in an RFID tag.

DISCUSSION
This command is designed to perform noncontiguous address writes to an RFID tag. Before a noncontiguous write command can be performed, the addresses must be preconfigured-configured using the configuration command (Command 03).

This command has the same control structure as the noncontiguous read command, except the port address and command number are followed by the data to be written into the preconfigured addresses on the RFID tag. Since all data is stored in 8-bit data format, the MSB of each data word are set to 00H. Data to be stored is always placed in the LSB of the data word.

The data must be written in the same sequence as when configured using the configure command. If the amount of data written by this command does not match the amount of data for which the port was configured, an error response will be received.

EXAMPLE
The following example illustrates a noncontiguous write command issued after the addresses are preconfigured using the example presented with the configuration command (Command 03). It directs the antenna to write 44H to address 3040H and 67H to address 3042H.

Command from PLC

MSB	LSB	Remarks
00H	02H	ANT port, perform Command 2
00H	44H	Write 44H to Write Address 1
00H	67H	Write 67H to Write Address 2
FFH	FFH	Message Terminator

Response from CM900

MSB	LSB	Remarks
00H	02H	Port echo, Command echo
FFH	FFH	Message Terminator

Command 3 (03 Hex): RF Port Configure Noncontiguous R/W Addresses

DESCRIPTION
Set up all non-contiguous Read/Write data addresses for the RFID port. Must be performed before Commands 1 or 2, or an error will occur.

DISCUSSION
This command configures the addresses to be accessed on the RFID tag when either a Noncontiguous Read (Command 1) or Noncontiguous Write (Command 2) is directed from the host PLC. No tag or antenna communications are initiated by using this command. A Read Address Terminator, FFF0H, and a Write Address Terminator, FFF1H, are always required, regardless of whether or not both reads and writes are being configured.

After the configure command is executed, any sequence of noncontiguous read or write commands can subsequently be executed. When using the Noncontiguous Write command, data must be presented in the same sequence as configured. Likewise, the read command returns data in the same sequence as configured.

EXAMPLE

Configures the Noncontiguous Read command for the antenna to read at addresses 0005H, 0100H, 0101H, 04AAH and 0597H, and the Noncontiguous Write command to write at addresses 3040H and 3042H.

Command from PLC

MSB	LSB	Remarks
00H	03H	ANT port, perform Command 3
00H	05H	Read Address 1 = 0005H
01H	00H	Read Address 2 = 0100H
01H	01H	Read Address 3 = 0101H
04H	AAH	Read Address 4 = 04AAH
05H	97H	Read Address 5 = 0597H
FFH	F0H	Read Address Terminator
30H	40H	Write Address 1 = 3040H
30H	42H	Write Address 2 = 3042H
FFH	F1H	Write Address Terminator
FFH	FFH	Message Terminator

Response from CM900

MSB	LSB	Remarks
00H	03H	Port echo, Command echo
FFH	FFH	Message Terminator

Command 4 (04 Hex): RF Port Fill Tag

DESCRIPTION
Fill an RFID tag with a one-byte value over multiple contiguous addresses.

DISCUSSION
This command is commonly used to clear an RFID tag's memory. It writes a one-byte value repetitively across a specified range of tag addresses, up to 8K bytes at a time. It should be noted that an 8K byte fill, which occurs at 3000 bytes/second, will supersede any other command to the CM900 for up to 2.6 seconds.

The fill function requires one data value byte, a starting address, and a fill length. It will then proceed to fill the tag with the data value byte, starting at the specified start address for the specified number of consecutive bytes.

EXAMPLE
Writes 'A' (41H) to the tag starting at address 0005H for the following next consecutive 2048 bytes.

Command from PLC

MSB	LSB	Remarks
00H	04H	ANT port, perform Command 4
00H	05H	Start Address = 0005H
08H	00H	Fill Length= 2048 bytes (0800H)
00H	41H	Data Value Byte = 41H
FFH	FFH	Message Terminator

Response from CM900

MSB	LSB	Remarks
00H	04H	Port echo, Command echo
FFH	FFH	Message Terminator

Command 5 (05 Hex): RF Port Block Read

DESCRIPTION
Read a block of data from an RFID tag.

DISCUSSION
The RF Port Block Read command is used to read segments of data from contiguous areas of tag memory. It is capable of handling up to 98 bytes of data transferred to the PLC with one command, with an additional two bytes used to transmit the command echo.

Unlike the noncontiguous reads and writes, the block read does not need a configuration command to precede it. The block read consists of a start address and quantity, followed by the message terminator, FFFFH, as shown below.

The data read from the tag is returned in the LSB of the register, and the MSB is always 00H.

EXAMPLE:
Reads 8 bytes of data from the tag starting at address 0101H.

Command from PLC

MSB	LSB	Remarks
00H	05H	ANT port, perform command 5
01H	01H	Start Address = 0101H
00H	08H	Read Block Length = 8 bytes (0008H)
FFH	FFH	Message Terminator

Response from CM900

MSB	**LSB**	**Remarks**
00H	05H	Port echo, Command echo
00H	52H	Read Data 1 = 52H
00H	46H	Read Data 2 = 46H
00H	49H	Read Data 3 = 49H
00H	44H	Read Data 4 = 44H
00H	20H	Read Data 5 = 20H
00H	54H	Read Data 6 = 54H
00H	61H	Read Data 7 = 61H
00H	67H	Read Data 8 = 67H
FFH	FFH	Message Terminator

Command 6 (06 Hex): RF Port Block Write

DESCRIPTION
Write a block of data to an RFID tag.

DISCUSSION
The RF Port Block Write command is used to write segments of data to contiguous areas of tag memory. It is capable of transferring up to 98 bytes of data transferred from the PLC with one command, with an additional two bytes used to transmit the command.

Unlike the noncontiguous reads and writes, the Block Write does not need a configuration command to precede it. The Block Write consists of a start address followed by the data stream to be written to the RFID tag.

The data to be written to the tag is contained in the LSB of the register, and the MSB is always 00H.

EXAMPLE:
Writes 8 bytes of data to the tag starting at address 0400H.

Command from PLC

MSB	LSB	Remarks
00H	06H	ANT port, perform Command 6
04H	00H	Start Address = 0400H
04H	00H	Write Data 1 = 52H
00H	46H	Write Data 2 = 46H
00H	49H	Write Data 3 = 49H
00H	44H	Write Data 4 = 44H
00H	20H	Write Data 5 = 20H
00H	54H	Write Data 6 = 54H
00H	61H	Write Data 7 = 61H
00H	67H	Write Data 8 = 67H
FFH	FFH	Message Terminator

Response from CM900

MSB	LSB	Remarks
00H	06H	Port echo, Command echo
FFH	FFH	Message Terminator

Command 10 (10 Hex): Serial Port Configure

DESCRIPTION
Sets the serial communication protocol for the Serial Ports COM1 and COM2. Please note that the COM2 port is RS232 only.

DISCUSSION
This command will set up the serial communication protocol for a specified serial port. Table 4 lists the available serial port configuration options, and the appropriate hex values. The configuration options must be provided in the same order as listed in Table 4 .

Table 4 - Serial Port Protocol Settings

Parameter	Hex Equivalent	Parameter	Hex Equivalent
Interface Type		Parity	
RS232	00E8H	None	0001H
RS422	01A6H	Even	0002H
		Odd	0003H
Baud Rate		Data Bits	
300	012CH	8	0008H
600	0258H	7	0007H
1200	04B0H		
2400	0960H	Stop Bits	
4800	12C0H	1	0001H
9600	2580H	2	0002H
19200	4B00H	2	0002H

EXAMPLE
Sets Serial Port COM1 to RS232, 9600 baud, no parity, 8 data bits, 1 stop bit.

Command from PLC

MSB	LSB	Remarks
01H	10H	COM1 port, perform Command 10
00H	E8H	Set Interface Type to RS232
25H	80H	Set Baud Rate to 9600
00H	01H	Set Parity to none
00H	08H	Set Data Bits to 8
00H	01H	Set Stop Bits to 1
FFH	FFH	Message Terminator

Response from CM900

MSB	LSB	Remarks
01H	10H	Port echo, Command echo
FFH	FFH	Message Terminator

Command 11 (11 Hex): Serial Port Block Read

DESCRIPTION
Read a specified number of bytes from a specific serial port.

DISCUSSION
The Serial Port Block Read command is used to read a given quantity of bytes from the specified serial port. Remember that there is a maximum of 100 registers of data that can be passed through the backplane interface per read, resulting in 198 bytes of ASCII data that can be transferred, with an additional two bytes used to transmit the command.

Unlike the RFID read and write commands, the serial read command will return data in the MSB of the registers. This allows for more data to be transferred from the connected serial device.

There is an optional delay for serial input that can be included in the command. The delay is measured in increments of 5 milliseconds. The CM900 will try for the specified delay period to read from the serial port. The CM900 will not accept any other command while it is waiting to accept serial data in the port.

EXAMPLE
Reads nine bytes of data from serial port COM1, with a 400 (0190H) x 5 milliseconds = 2 second delay.

Command from PLC

MSB	LSB	Remarks
01H	11H	COM1 port, perform Command 11
00H	09H	Read 9 bytes
01H	90H	2 second delay
00H	00H	Terminating Character
FFH	FFH	Message Terminator

Response from CM900

MSB	LSB	Remarks
01H	11H	Port echo, Command echo
44H	41H	Read Data 1 & 2 = 'DA' (44H, 41H)
54H	41H	Read Data 3 & 4 = 'TA' (54H, 41H)
4CH	4FH	Read Data 5 & 6 = 'LO' (4CH, 4FH)
47H	49H	Read Data 7 & 8 = 'GI' (47H, 49H)
43H	00H	Read Data 9 = 'C' (43H)
FFH	FFH	Message Terminator

Command 12 (12 Hex): Serial Port Block Write

DESCRIPTION
Write a specified number of bytes to a specific serial port.

DISCUSSION
The Serial Port Block Write command is used to write a given quantity of bytes to the specified serial port. Remember that there is a maximum of 100 registers of data that can be passed through the backplane interface per read.

Unlike the RFID read and write commands, the serial write command utilizes the MSB as well as the LSB of the registers. This allows for more data to be transferred to the connected serial device.

EXAMPLE
Write 8 bytes of data to serial port COM1.

Command from PLC

MSB	LSB	Remarks
01H	12H	COM1 port, perform Command 12
42H	42H	Write Data 1 & 2 = 'BA' (42H, 41H)
52H	20H	Write Data 3 & 4 = 'R ' (52H, 20H)
43H	4FH	Write Data 5 & 6 = 'CO' (43H, 4FH)
44H	45H	Write Data 7 & 8 = 'DE' (44H, 45H)
FFH	FFH	Message Terminator

Response from CM900

MSB	**LSB**	**Remarks**
01H	12H	Port echo, Command echo
FFH	FFH	Message Terminator

Command 13 (13 Hex): Clear Serial Port

DESCRIPTION
This command is used to clear the 256K byte serial buffer on the specified CM900 serial port.

DISCUSSION
This command has a time out value to ensure that if a stream of data is being sent to the CM900, the CM900 will not delay clearing the buffer too long.

EXAMPLE
The following example will clear the 256K buffer on serial COM1, the Clear Serial Buffer Command cannot exceed 2 seconds.

Command from PLC

MSB	LSB	Remarks
01H	13H	COM1 port, perform Command 13
01H	90H	Command time out (0190H x 5 ms = 2 sec.)
FFH	FFH	Message Terminator

Response from CM900

MSB	**LSB**	**Remarks**
01H	13H	Port echo, Command echo
FFH	FFH	Message Terminator

Command 20 (20 Hex): Posted Block Write

DESCRIPTION
This command posts an RF Block Write on the antenna port.

DISCUSSION
The antenna is polled for twenty milli-seconds every program scan of the CM900. Bit 2 is set to indicate that a Posted Block Write is in progress. When an RF tag moves within range of the polling antenna the Block Write will be complete. As the posted write is completed, bit 0 is set, and bit 2 is cleared. See page 35 for information on the Status Byte.

Note:
If another command is called during the polling that takes two seconds or longer to complete, i.e. a serial command with a two second time-out, the antenna will not get polled for the time required by that command.

EXAMPLE

The following command will post a contiguous Block Write on the antenna port. When a tag comes into range of Antenna 0, starting at address 10 dec on the tag it will write 3 hex, E hex, and A hex in consecutive addresses.

Command from PLC

MSB	LSB	Remarks
00H	20H	ANT port, perform Command 20
00H	0AH	Posted Block Write starting Address (10 dec)
00H	03H	Posted data to be written at starting address (10 dec)
00H	0DH	Posted data to be written at starting address plus one (11 dec)
00H	0E	Posted data to be written at starting address plus two (12 dec)
00H	0AH	Posted data to be written at starting address plus three (13 dec)
FFH	FFH	Message Terminator

Response from CM900

MSB	**LSB**	**Remarks**
00H	20H	Port echo, Command echo
FFH	FFH	Message Terminator

Command 21 (21 Hex): Posted Block Read

DESCRIPTION
This command posts a contiguous Block Read on a Antenna 0.

DISCUSSIONS
The antenna is polled for twenty milli-seconds every scan of the CM900. Bit 3 will indicate that a posted Block Read is in progress. When an RF tag is within range of the polled antenna, the Block Read will be completed and the data read will be stored in the Posted Read Data Buffer in the CM900. As the posted Block Read is completed, the CM900 will turn on bit 1 and change bit 3. See page 35 for information on the Status Byte.

Note:
If another command is called during the polling that takes two seconds or longer to complete, i.e. a serial command with a two second time-out, the antenna will not get polled for the time required by that command.

EXAMPLE
The following command will post a Block Read on the antenna port at address 16 decimal for a length of five bytes.

Command from PLC

MSB	LSB	Remarks
00H	21H	ANT port, perform Command 21
00H	10H	Posted Block Read starting Address (16 dec)
00H	05H	Posted Block read length (5 dec)
FFH	FFH	Message Terminator

Response from CM900

MSB	**LSB**	**Remarks**
00H	21H	Port echo, Command echo
FFH	FFH	Message Terminator

Command 22 (22 Hex): Read Posted Read Data Buffer

DESCRIPTION
This command reports the last data to be stored in the buffer by a Posted Block Read command.

DISCUSSION
CM900 will pass data stored in the buffer from the RF antenna to the PLC and update Status Byte bit 1.

EXAMPLE
The following example requests the CM900 to read the data collected in the Posted Read Data Buffer from the RF antenna.*

Command from PLC

MSB	LSB	Remarks
00H	22H	RF port, perform Command 22
FFH	FFH	Message Terminator

Response from CM900

MSB	**LSB**	**Remarks**
00H	22H	Port echo, Command echo
00H	23H	Data read at starting address (16 dec)
00H	45H	Data read at starting address plus one(17 dec)
00H	BCH	Data read at starting address plus two (18 dec)
00H	DEH	Data read at starting address plus three (19 dec)
00H	98H	Data read at starting address plus four (20 dec)
FFH	FFH	Message Terminator

* Addresses are from the Post Block Read example on page 33.

Command 23 (23 Hex): Posted Commands Status Byte

DESCRIPTION

This command reports the status of all posted commands pending or completed for the RF port.

DISCUSSION

The Status Byte has the following structure:

Table 5 — Posted Command Status Byte Structure

Bit	Value	Description
7	0	Spare - always set to 0
6	0	Spare - always set to 0
5	1	Spare - always set to 1
4	1	Spare - always set to 1
3	0 or 1	**Posted Block Read Command in Process** Set to 1 — After Posted Block Read was requested and before it is completed Reset to 0 — After tag moves into range of antenna and Posted Block Read Is completed — Cancel All Posted Operations Command has been requested
2	0 or 1	**Posted Block Write Command in Process** Set to 1 — After Posted Block Write was requested and before it is completed Reset to 0 — After tag moves into range of antenna and Posted Block Write Is completed — Cancel All Posted Operations Command has been requested
1	0 or 1	**Posted Block Read Complete** Set to 1 — Requested Posted Block Read was completed, Posted Read Data Buffer ready to read Reset to 0 — After Read Posted Block Read Data Buffer has been requested — Cancel All Posted Operations Command has been requested
0	0 or 1	**Posted Block Write Complete** Set to 1 — Requested Posted Block Write was completed Reset to 0 — After Status Byte has been requested — When a new posted Write/Read is requested — Cancel All Posted Operations Command has been requested

EXAMPLE

The following command requests the Posted Status Byte for the RF antenna.

Command from PLC

MSB	LSB	Remarks
00H	23H	ANT port, perform Command 23
FFH	FFH	Message Terminator

Response from CM900

MSB	**LSB**	**Remarks**
00H	23H	Port echo, Command echo
00H	34H	Status byte for RF antenna
FFH	FFH	Message Terminator

Command 24 (24 Hex): Cancel Posted Operations

DESCRIPTION
This command cancels all Posted Read/Write commands and sets bits 0 - 3 of the Posted Status Byte to zero.

EXAMPLE
The following command will cancel all Posted Read/Write commands.

Command from PLC

MSB	LSB	Remarks
00H	24H	ANT port, perform Command 24
FFH	FFH	Message Terminator

Response from CM900

MSB	**LSB**	**Remarks**
00H	24H	Port echo, Command echo
FFH	FFH	Message Terminator

5.7 Error Codes

The Standard Program will return the an error if it encounters a fault during operation. Error codes are returned in the LSB of the second register passed to the PLC. Table 6 lists these hex error codes and their meanings.

Table 6 — Error Codes

Radio Frequency Error Codes

Error Code	Description
01	Non-Contiguous Read has failed
02	Non-Contiguous Write has failed
03	Non-Contiguous Read/Write Configuration has failed
04	Fill Operation has failed
05	Contiguous Block Read has failed
06	Contiguous Block Write has failed
08	Search Tag Operation failed
20	Non-contiguous Read/Write attempted without Pre-Configuration
21	Input Command does not match pre-defined format

Serial Commands Error Codes

Error Code	Description
20	Serial configuration command, invalid mode (232 or 422)
21	Serial configuration command, invalid baud rate (300, 600, 1200, 2400, 4800, 9600, 19200)
22	Serial configuration command, invalid parity assignment (1-none, 2-even, 3-odd)
23	Serial configuration command, invalid data bit assignment (7, 8)
24	Serial configuration command, invalid stop bit assignment (1, 2)
25	Serial read command, invalid amount of data to read in (1-124)
26	Serial read command, invalid timeout (1-32, 767)
27	Serial read command, timeout was achieved before data reached the port
28	Serial port clear buffer command, timeout was achieved before the port was cleared, possible data remaining in port
29	Serial port requested does not exist on the CM900
2A	COM2 is configured for RS422 communications

Table 6 (continued) — Error Codes

Posted Radio Frequency Error Codes

Error Code	Description
51	Posted read/write requested was too large (should be less than 100 bytes)
52	Posted command is already active on antenna port one
53	Posted read/write address is out of range
54	Request for posted read buffer where there is no data present to report

Miscellaneous Error Codes

Error Code	Description
40	Port assignment does not match the command assignment
41	End terminator (0xFFF) was not located in the register packet

A APPENDIX: NOTICE OF EMISSIONS

A.1 U.S. FCC Regulations

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

Changes or modifications not expressly approved by EMS could void the user's authority to operate this equipment.

A.2 Canadian RFI Regulations

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la classe B prescrites dens le Reglement sur le brouillage readioelectrique edicte par le ministere des Communications du Canada.

B APPENDIX: SPECIFICATIONS

Table 7 shows specifications for the CM900.

Table 7 - CM900 Specifications

Electrical	
Backplane - supplied by PLC	
Supply Voltage	— 5 VDC ± 5%
Max. Current	— 250 mA
Front End - external supply required	
Supply Voltage	— 24 VDC ± 5%
Max. Current	— 250 mA, 750 mA with RF antenna connected
Max. Ripple	— 2.0% of DC voltage
Internal Memeory	
Master Microprocessor	— 32K byte battery-backed static RAM
Application Program Storage	— 32K byte EEPROM, 2K used by system
Communication with Host	
Compatibility	— Modicon Compact 984 PLC, direct-connect to backplane
Interface	— Modicon proprietary interface
RF Interface	
RFID Port Name	— ANT
Compatibility	— EMS HS500-Series Read/Write RFID antennas
Interface	— Proprietary EMS RFID interface
Max. Cable Length	— 4,000 ft. (1,200 m)
Serial Interface	
Serial Port Names	— COM1, COM2 (Programming/Debug)
Compatibility	— Any third party external serial devices
Interface	— COM1 - RS232/RS422, COM2 - RS232
Baud Rate	— 300, 600, 1200, 2400, 4800, 9600, 19200
Parity	— None, Odd, Even
Data Bits	— 7 or 8
Stop Bits	— 1 or 2
Modicon Interface	
Traffic-Cop Compatibility	— CM900 for 6-register transfer
SP1004 Loadable	— PLC function block allows transfer of 1-100 registers of data between PLC and CM900

Table 7 - CM900 Specifications (continued)

Mechanical Specifications	
Dimensions (W x H x D)	— 1.57 x 5.59 x 4.43 in. (40 x 142 x 112.5 mm)
Weight	— .62 lbs
Connectors	
Backplane	— Direct plug-in to Modicon Compact 984 PLC Housings
22-position plug-in terminal strip	— 24 VDC, COM1, COM2, ANT
LED Indicator —	— Power, Error, COM1 RX, COM1 TX, COM2 RX, COM2 TX, ANT
Environment	
Operating Temp	— +32° to +140° F (0° to +60°C)
Non-Operating Temp	— -40° to +185° F (-40° to +85°C), per IEC 68-2-14, Test Nb
Storage Temp	— -40° to +185° F (-40° to +85°C), per IEC 68-2-1/2, Test Ab and Bb
Humidity	— 0 to 95% non-condensing, per IEC 68-2-3, Test Ca
Shock Resistance	— 30G for 11 ms, per IEC 68-2-27, Test Ea
Vibration Resistance	— 1 G at 3 to 500 Hz for 23 minutes per plane, 1 octave/minute in all three planes per IEC 68-2-6, Test Fc
Altitude	— 15,000 ft. (4,540 m), per MIL-STD-810, Method 500.2, low pressure
ESD Immunity	— 4kV to all surfaces, per IEC 801-2, level tests
Magnetic Immunity	— Per IEC 801-3, Level 3
Noise Emissions	— FCC Part 15, Subpart B, Class A; CDC Class B

C APPENDIX: MODELS & ACCESSORIES

Table 8 lists the available models and accessories for the CM900.

Table 8 — Models and Accessories

Available Models	
Part Number	Description
CM900	Automatic Identification module for Modicon 984-A120 Compact and Micro programmable controller. One RFID port for EMS RFID antennas and two serial communications ports for interface to external serial devices.
Accessories	
Part Number	Description
SP1011-LIB	Software manual and libraries for use in developing custom application programs for the CM900. Diskette includes libraries and standard program source code, does not include C compiler, tools or compiler manual. C programming experience required.
88-1001	Franklin C compiler for CM900 software development
SP1004	Software loadable program for most models of Modicon 984 CPU (excluding 984-A, -B, -X) and most models of the Modicom Compact Series (excluding compact CPU - 120 models). Required to run the standard program.
CBL-1182	Demonstration cable set, includes two 10 ft. long RS232 connection cables to the main (DB-25S) and programming ports (DE-9P), 10 ft. long connection cable for a HS500/HS501antenna, and 24 VDC wall mount power supply. Terminal connectors included.
CBL-1183	Demonstration cable set, includes two 10 ft. long RS232 connection cables to the main (DB-25S) and programming ports (DE-9P), 10 ft. long connection cable for a HS500A/HS501A antenna, and 24 VDC wall mount power supply. Terminal connectors included.
CBL-1184	Cable assembly, PC AT-to-CM900 programming cable, DE-9S to terminal strip. Includes power supply.
CBL-1185	Cable assembly, PC XT-to-CM900 programming cable, DB-25S to terminal strip. Includes power supply.
46-1286	Connector assembly, CM900, for connection to pins 1-11
46-1285	Connector assembly, CM900, for connection to pins 12-22
Replacement Parts	
17-1122	Operator's Manual, CM900 AutoID Interface Module
17-1079	Software Manual, SP1011-LIB
17-1080	Software Manual, SP1004 Software Loadable for the Modicon Compact Series 984/CM900 Interface

D APPENDIX: ASCII CHART

Decimal	Hex	Character	Decimal	Hex	Character
000	00	NUL	032	20	(space)
001	01	SOH	033	21	!
002	02	STX	034	22	”
003	03	ETX	035	23	#
004	04	EOT	036	24	$
005	05	ENQ	037	25	%
006	06	ACK	038	26	&
007	07	BEL	039	27	‘
008	08	BS	040	28	(
009	09	HT	041	29	)
010	0A	LF	042	2A	*
011	0B	VT	043	2B	+
012	0C	FF	044	2C	’
013	0D	CR	045	2D	-
014	0E	SO	046	2E	.
015	0F	SI	047	2F	/
016	10	DLE	048	30	0
017	11	DC1	049	31	1
018	12	DC2	050	32	2
019	13	DC3	051	33	3
020	14	DC4	052	34	4
021	15	NAK	053	35	5
022	16	SYN	054	36	6
023	17	ETB	055	37	7
024	18	CAN	056	38	8
025	19	EM	057	39	9
026	1A	SUB	058	3A	:
027	1B	ESC	059	3B	;
028	1C	FS	060	3C	<
029	1D	GS	061	3D	=
030	1E	RS	062	3E	>
031	1F	US	063	3F	?

Decimal	Hex	Character	Decimal	Hex	Character
064	40	@	098	62	b
065	41	A	099	63	c
066	42	B	100	64	d
067	43	C	101	65	e
068	44	D	102	66	f
069	45	E	103	67	g
070	46	F	104	68	h
071	47	G	105	69	i
072	48	H	106	6A	j
073	49	I	107	6B	k
074	4A	J	108	6C	l
075	4B	K	109	6D	m
076	4C	L	110	6E	n
077	4D	M	111	6F	o
078	4E	N	112	70	p
079	4F	O	113	71	q
080	50	P	114	72	r
081	51	Q	115	73	s
082	52	R	116	74	t
083	53	S	117	75	u
084	54	T	118	76	v
085	55	U	119	77	w
086	56	V	120	78	x
087	57	W	121	79	y
088	58	X	122	7A	z
089	59	Y	123	7B	{
090	5A	Z	124	7C	|
091	5B	[	125	7D	}
092	5C	\	126	7E	~
093	5D	]	127	7F	DEL
094	5E	^			
095	5F	—			
096	60	‘			
097	61	a			

Notes: