MARC UNIVERSAL PROTOCOL EMULATION

1.1 GENERAL DESCRIPTION

The MARC protocol is specifically designed to provide a "universal" method of communication with many different types of devices that use a wide variety of communication protocols. The protocol is an asynchronous byte oriented protocol that is compatible with most modern computer communication ports. The most common use for this protocol is in Supervisory Control and Data Acquisition (SCADA) systems where a host device needs to talk to many different types of remote devices. Typically, a MARC Comm-Adapter™ is used to convert the Universal protocol to the specific protocol of the remote devices. A Comm-Adapter can have up to eight (8) communications ports, each communicating with a different protocol. Communications can proceed simultaneously on each communications port. Communication security on the Universal protocol is provided by a simple checksum only since the connection between it and a host is almost always a direct wire connection. The communication security method used between the Comm-Adapter and the remote devices is the standard error detection of the remote device.

All communications exchanges in MARC protocol are initiated by the host, in this case the Comm-Master. The remote device (Comm-Adapter) cannot initiate any exchange with the host. The Comm-Adapter will always return a response to the host: Either a return message from the address remote port or an error message will be returned. The response will always contain a status byte that can be examined to determine the exace status of the current communication message.

1.2 MESSAGE STRUCTURE

The Comm-Master communicates with the remote device using the MARC Universal Protocol described in the following sections. The Universal Protocol is general in nature so that the Comm-Master can collect data from many different types of remote devices.

The message format uses a form of "data link escape" protocol. There are three character values that the transmitted data will not be allowed to have. The values, in hexadecimal, are "F1", "F2" and "F3". These characters are always considered to be control characters. The code "F1" always stands for "Start of Transmission" and will only be present at the beginning of a message. The code "F2" is always used as a "data link escape" code (explaned further below) and the code "F3" is always used as the last character in a message.

The "data link escape" character, F2, is used when one of the special codes (F1, F2 or F3) is to be sent as data. When the sender detects that the character to be transmitted is one of the special codes a F2 is inserted in the message followed by the data after a hexadecimal 20 has been added to it. At the receive end when the code F2 is detected, the receiver will discard the F2 and subtract 20_H from the next character that is received.

The messages have a security LRC code appended to the end of the data but before the end of transmission code (F3). The LRC is the "exclusive or" of the data items as they are to be transmitted. The LRC code is one byte in length and is initialized to zero prior to performing the exclusive "OR" of the data. The "start of Transmission" character, all message data bytes and the "Data Link Escape" codes (if any) which appear in the message body are included in the LRC. In the event a data byte is detected that matches one of the control codes it will be altered prior to being merged into the LRC. The LRC code will not include itself or the possible escape code which may precede it due to matching one of the three control codes.

1.3 GENERAL PROTOCOL FORMAT

The following example is used to describe the general format of the communications protocol.

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER (1-8)
CCCCCCCC	MESSAGE TYPE(FUNCTION CODE)
********	DATA (AS REQUIRED)
********	DATA
11110010	DATA LINK ESCAPE
%%%%%%%%	DATA + 20H
********	DATA
VVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 1 General Protocol Format

1.4 Message Types

The Comm-Adapter supports the following message types:

TYPE #	MESSAGE DESCRIPTION
01	Status Request
02	Information Request
03	Set Port Timeout
04	Download Variables
05	Reset Remote Processor and Ports
10	Control Request
100	Set Passthru Mode
101	Clear Passthru Mode
103	Passthru Message

Figure 2 Valid Message Types

1.4.1 STATUS REQUEST (FC= 01)

A status request poll command can be issued at any time to read the current status of the remote device. The format of the status request message is shown below. The message returned provides diagnostic information for the requested port. The information includes the number of communication attempts, the number of good responses, the number of no replies and the number of errors detected and a protocol converter ID string. At the end of the list of data is a single byte which contains the current status of the remote adapter itself. All message responses have a status byte that is returned as the last byte of the message. Figure 5 defines the status codes. The Status Request message is sent using a Comm-Master "Poll".

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER
00000001	STATUS REQUEST
00000000	NOT USED
00000000	NOT USED
00000000	NOT USED
00000000	NOT USED
00000000	NOTUSED
VVVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 3 Status Request Message

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER (echo)
00000001	FUNCTION CODE (echo)
AAAAAAA	NUMBER OF RTU INQUIRES HI
AAAAAAAA	NUMBER OF RTU INQUIRES LO
BBBBBBBB	NUMBER OF RTU REPLIES HI
BBBBBBBB	NUMBER OF RTU REPLIES LO
FFFFFFFF	NUMBER OF NO RESPOSNSES HI
FFFFFFFF	NUMBER OF NO RESPONSES LO
$$$$$$$$	PORT PROTOCOL ID STRING
	(VARIABLE LENGTH STRING)
SSSSSSSS	COMM-ADAPTER STATUS
VVVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 4 Status Request Response

0	ALL OK
1	INVALID PORT ADDRESS
2	INVALID RTU ADDRESS
3	INVALID POINT NUMBER
4	BAD DATA FROM RTU
5	CONFIGURATION REQUEST
6	RTU MESSAGE TIMEOUT
7	INVALID FUNCTION CODE RECEIVED
8	LRC ERROR IN LAST RECEIVED MSG.
9	DATA ERROR IN LAST RECEIVED MSG

10	DATA OVERRUN ERROR
11	SIO ERROR IN RTU COMM.
12	INVALID DATA IN REQUEST
40	SOFTWARE ERROR (STACK ERROR)
80	POWER ON CLEAR FLAG
100	TOO SHORT MESSAGE
101	TOO LONG MESSAGE
ALL OTHER ERROR CODES ARE UNASSIGNED	

Figure 5 Comm-Adapter Status Response Codes

1.4.2 REMOTE INFORMATION REQUEST (FC= 02)

The Comm-Master can request data from any Comm-Adapter Port and RTU at any time. The information request format is shown in Figure 6. The Information Request is forwaraded to the addressed port on the Comm-Adapter. The protocol converter card installed in the port will determine how the message received from the Comm-Master will be processed. It reformats the message into a form that is compatible with the remotes connected to the port. The Remote Information Request is issued useing a Comm-Master "Poll".

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER
00000010	INFORMATION REQUEST
XXXXXXXX	RTU NUMBER
XXXXXXXX	DATA TYPE
XXXXXXXX	START CHANNEL
XXXXXXXX	START POINT
XXXXXXXX	NUMBER OF POINTS
VVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 6 Information Request Message

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER (echo)
00000010	FUNCTION CODE (echo)
XXXXXXXX	RTU NUMBER (echo)
XXXXXXXX	DATA AS REQUESTED
XXXXXXXX	DATA
XXXXXXXX	DATA
SSSSSSS	COMM-ADAPTER STATUS
VVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 7 Information Request Response

1.4.3 SET PORT TIMEOUT (FC= 03)

The length of time that any Comm-Adapter port will wait for a reply is set by sending a message with the function code set to 3. The format of the message is shown below. The Set Timeout message is sent using a Comm-Master "Command Message".

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER
00000011	SET PORT TIMEOUT
XXXXXXXX	TIMEOUT VALUE HI
XXXXXXXX	TIMEOUT VALUE LO
00000000	NOT USED
00000000	NOT USED
00000000	NOT USED
VVVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 8 Set Timeout Message

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER (echo)
00000010	FUNCTION CODE (echo)
XXXXXXXX	COMM-ADAPTER STATUS
VVVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 9 Timeout Message Response

1.4.4 DOWNLOAD VARIABLES TO PORT (FC= 04)

The Comm-Adapter maintains an area of dual-ported RAM in each installed co-processor port. This area is typically used for selections of various options that are particular for the protocol firmware installed in the co-processor. The Download Variables function allows the host device to write data to this block of memory. The number of bytes that are used and the function of each byte is dependant on the particular protocol. The maximum size of the download block is 20 bytes. Figure 10 details the download block for TEJAS protocol. A soft reset for the addressed port is automatically issued to use the new values in the download buffer The Download Variables function is sent using a Comm-Master "Command Message".

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER
00000100	DOWNLOAD REQUEST
00000000	NOT USED
00000000	NOT USED
00000000	NOT USED
00000000	NOT USED
XXXXXXXX	NUMBER OF BYTES
XXXXXXXX	DATA BYTES AS SPECIFIED
XXXXXXXX	
VVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 10 Download Variables Message

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER (echo)
00000010	FUNCTION CODE (echo)
SSSSSSS	COMM-ADAPTER STATUS
VVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 11 Download Variables Response

BYTE #	NAME	DEFAULT	FUNCTION
1	POCFLAG	10000000	POWER ON FLAG
2	SPMR1	00000111	MODE REGISTER ONE
3	SPMR2	00000111	MODE REGISTER TWO
4	SPCSEL	01100110	CLOCK SELECT REGISTER
5	TJMODE	00000000	ERROR CHECK MODE 0= LRC, 1= CRC
6	RADIODELAY	00000000	RADIO ON/OFF DELAY HI
7	RADIODELAY	00011110	RADIO ON/OFF DELAY LO (10MS PER COUNT)
8	JEMVALID	00000000	JEM METERS VALID IF NOT 0
9	JEMSIZE	00000000	# BYTES FOR JEM READ, EACH DEVICE
10	CARRIER	00000000	0= CONSTANT CARRIER, 1= CONTROLLED
11-20	NOT USED		

Figure 12 Download Variables for TEJAS

BINARY CODE	FUNCTION
00000000	# DATA BITS = 5
00000001	# DATABITS = 6
00000010	# DATA BITS = 7
00000011	# DATA BITS = 8
00010000	PARITY OFF
00000000	PARITY ON
00000100	PARITY ODD
00000000	PARITY EVEN

MODE REG 1

BINARY CODE	FUNCTION
00000111	ONE STOP
00001111	TWO STOP
00010000	USE CTS

MODE REG 2

BINARY CODE	FUNCTION
00000000	50 BAUD
00010001	110 BAUD
00100010	134.5 BAUD
00110011	200 BAUD
01000100	300 BAUD
01010101	600 BAUD
01100110	1200 BAUD
01110111	1050 BAUD
10001000	2400 BAUD
10011001	4800 BAUD
10101010	7200 BAUD
10111011	9600 BAUD
11001100	38.4 BUAD

CLOCK SELECT

Figure 13 Serial Port Control Register Options

1.4.5 RESET COMM-ADAPTER OR SELECTED PORT (FC= 05)

The Comm-Adapter main processor or any one of its 8 ports can be reset by sending a Reset Comm-Adapter message. If the Port ID used in the message is zero then the entire Comm-Adapter (host port plus all slave ports) is reset. If the Port ID field is a number between 1 and 8 then only the port corresponding to the Port ID field is reset. A Comm-Adapter reset forces a hardware reset to all devices on the bus and restarts the system from the beginning; all hardware diagnostics, RAM and EPROM testing are done and the ports are reinitialized to their default configurations. A reset to a particular port on the other hand is "soft" reset which does not re-do all the diagnostic tests and restarts the ports using the current values in the download buffers for the port. The Reset Comm-Adapter message is sent from the Comm-Master as a "Command Message"

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER
00000101	RESET PROCESSOR
XXXXXX	PROCESSOR TO RESET
00000000	NOT USED
00000000	NOT USED
00000000	NOT USED
XXXXXXXX	NUMBER OF BYTES
XXXXXXXX	DATA BYTES AS SPECIFIED
XXXXXXXX	
VVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 14 Reset Comm-Adapter or Port Message

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER (echo)
00000101	FUNCTION CODE (echo)
SSSSSSS	COMM-ADAPTER STATUS
VVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 15 Reset Response

1.4.6 CONTROL REQUEST COMMAND (FC= 10)

Messages that are reformatted and sent on to a remote device by the Comm-Adapter are called Control Requests. The format of the Control Request Command is shown in Figure 16. The Control Request Command is sent to the Comm-Adapter by using a Comm-Master "Command Message".

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER
00001010	CONTROL REQUEST
XXXXXXXX	RTU NUMBER
XXXXXXXX	DATA TYPE
XXXXXXXX	START CHANNEL
XXXXXXXX	START POINT
XXXXXXXX	NUMBER OF POINTS
VVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 16 Control Request Message

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER (echo)
00001010	FUNCTION CODE (echo)
SSSSSSS	COMM-ADAPTER STATUS
VVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 17 Control Response

1.4.7 SET PASSTHRU MODE ON (FC= 100)

Pass Thru Mode On (FC 100) ,Pass Thru Mode Off (FC 101) and Send Pass Thru Message are related functions and operate as described below. The "Pass Thru" mode is included in the Comm-Adapter to cover special protocol cases that are not included in the basic functions described in the previous sections. The Pass Thru mode allows the host, in this case the Comm-Master, to build any type of message string and have the Comm-Adapter "pass it thru" unchanged to the remote device. Function Codes 100 and 101 turn the "Pass Thru" mode on and off for the specified port. Once the pass thru mode is turned on all subsequent data is written to the remote port just as it is received. The Comm-Master must send the complete message, formated as the remote would like to see it including the check characters at the end of the message. The Pass Thru functions are sent to the Comm-Adapter using the Comm-Master "Command Messages"

1.4.8 SET PASSTHRU MODE OFF (FC= 101)

Turns Pass Thru Mode off for the specified port. Normal port operation resumes after this function is received.

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER
XXXXXXXX	FUNCTION CODE (100 , OR 101)
XXXXXXXX	RTU NUMBER
00000000	NOT USED
00000000	NOT USED
00000000	NOT USED
00000000	NOT USED
VVVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 18 Pass Thru Mode On/Off Command

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER (echo)
XXXXXXXX	FUNCTION CODE (echo)
XXXXXXXX	RTU NUMBER (echo)
SSSSSSS	COMM-ADAPTER STATUS
VVVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 19 Pass Thru On/Off Response

1.4.9 SEND PASSTHRU MESSAGE (FC= 103)

A single message can be "passed thru" a Comm-Adapter port using function code 103. When this message is received by the Comm-Adapter the data is sent to the addressed port with no additional formating. The data must include all the fields of a remote message including the error check byte(s) at the end. The message also includes the number of bytes to expect in the RTU response. The message returned will be the actual data received from the remote with no changes. The error code will be returned as received. Pass thru messages are sent to the Comm-Adapter using a Comm-Master "Command Message".

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER
01100111	PASS THRU COMMAND
00000000	NOT USED
00000000	NOT USED
00000000	NOT USED
00000000	NOT USED
XXXXXXXX	NUMBER OF BYTES IN RESPONSE
XXXXXXXX	DATA AS REQUIRED (ACTUAL MSG
XXXXXXXX	DATA
VVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 20 Pass Thru Message

11110000	START OF TRANSMISSION
XXXXXXXX	PORT ID NUMBER (echo)
01100111	FUNCTION CODE (echo)
XXXXXXXX	DATA AS REQUESTED
XXXXXXXX	DATA
XXXXXXXX	DATA
SSSSSSS	COMM-ADAPTER STATUS
VVVVVVV	SECURITY LRC
11110011	END OF TRANSMISSION

Figure 21 Pass Thru Response

1.5 COMM-MASTER MARC UNIVERSAL PROTOCOL CONFIG. TABLE

The following paragraphs detail the orginization of the configuration table for a Comm-Troller with MARC Universal Communication protocol installed on the SCADA side.

1.5.1 Comm-Master MARC Configuration Header

Word offset 0 is used for 2 functions: Byte # 0 is used to define the Allen-Bradley Data Highway address of the interface module that is connected to the Comm-Master. This address is typically 11_8 but may be assigned to other values depending on the final system configuration. The address of the data highway interface module is used as the file address when reading or writing data to a PLC-5 system. The interface module can be assigned any address from 1 thru $77_{8.;}$ Byte # 1 is used to define the number of Polling Tables that are defined in the system. The Comm-Master will use this number to determine the number of Polling Table Entries to read.

Word offset 1 is used for a Radio Turn-On Delay Timer. This is the time that the Comm-Master will delay (hold-off) sending data after raising the Request To Send line (RTS). The delay time will be 10ms times the number stored in word 1.

Word offset 2 is used for a Radio Turn-Off Delay Timer. This is the time that the Comm-Master will hold the line quiesent after transmitting the last byte of data. This delay is sometimes required when useing the Comm-Master with some types of radio systems in order to insure the proper reception at the remote end. The delay time will be 10ms times the number stored in word 2.

Word offset 3 is reserved for future use. Set its value to 0000_H.

Word offset 4 is used for two functions. Byte # 0 is used to select the COMM-ADAPTER port Baud Rate. The only valid settings for this byte is $0B_H$ for 9600 baud. Byte 1 is used to select the number of data Bits option. It should be set to 08_H for eight data bits.

Word offset 5 is used for two options. Byte 0 is used to select the Comm-Adapter Port Parity option and byte 1 is used to select the number of stop bits to use. This configuration is fixed at a setting of 00 01_H which corresponds to no parity and 1 stop bit.

Word offsets 6 and 19 are reserved for future use. Set to 0000_H.

1.5.2 Polling Table Entry for MARC Universal Protocol

The Polling tables start immediately following the end of the configuration table header section. The polling tables are contiguous, one immediately following the other. Each Polling table is 20 words long. There is a polling table for each poll message (Information Request) that the Comm-Master is required to send. The number of polling tables to read is specified in the Configuration header word 0 byte 1 entry as described above.

Word offset 0 is used for two functions. Byte 0 (high byte) is used to define the Comm-Adapter Port address that is to be accessed with the poll command. It can be any number from 1 thru 8. Byte 1 is used to store the MARC Comm-Adapter function code that is to be used. Valid function codes are defined in Figure 2. The only valid codes for this application are 01 and 02, corresponding to Read Status and Information Request message types

Word offset 1 is used to store the number of bytes of data that are to be returned. The valid range for the number of bytes field is from 0 thru 255.

Word offset 2 is used to store the data source address. This is the address of the remote device on the communication channel specified by byte 00 of the Poll Table. Valid RTU addresses range from 0 thru 255.

Word offset 3 is used to specify the type of data that is expected. Valid data types are: 03 (register input), 05 (bit output), 06 (register output) and 0F (set multiple registers).

Word offset 4 is used to specify an address parameter for the remote device. This may be in the form of an address word hi byte, a function code or other address information depending on the type of port that will receive this command.

Word offset 5 is used to specify another address parameter for the remote device. This may be in the form of an address word low byte or the starting address of the data to be affected.

Word offsets 6 thru 9 are used to specify the "Data Destination Address" within the local PLC environment. The "Destination Address" is the location to which the data collected from the "Source Address" specified in poll table words 0 thru 5 will be written.

Word 6 is used to specify the destination PLC type and Data Highway Address. Set the high order byte (byte 0) to the destination PLC Type (02_H= PLC2, 05_H= PLC5, or FA_H= PLC5/250) depending on the type of PLC that will receive the data. Set the Low order byte to the Data Highway address of the destination PLC.

Word offset 7 is used to specify the Logical Processor (PLC5/250 only) and the File Type that is to receive the data. The high byte of the word is used for the logical processor number. The low byte of the word is used to specify the file type The value entered into Word 7 low byte is the HEX equivalent of the ASCII character that is used to represent the file type. For example, if the file type is binary (B), you should encode the destination address file type as 42_H.

Word offset 8 is used to specify the "Destination PLC" file number. The value entered into Word 8 is the HEX equivalent file number. For example if the data is to be written to file 10 then the file number should be entered as a HEX 000A. An alternative method for entering this field is to change the number format of the display from hex to decimal and simply enter the file number

Word offset 9 is used to specify the starting element in the file where the data will be written. Again either enter the hex equivalent of the starting address or enter the decimal value if displaying the file in decimal.

Word offset 10 is used to specify the interval between polls. Polls will be issued by the Comm-Master at the rate specified by the contents of this word. The polling interval can be specified in 10 ms increments. That is an entry of 200 (decimal) would result in the Comm-Master polling for the data specified in this table entry once every 2 seconds (200 X 10ms per count = 2000 ms = 2 sec)

Word offset 11 is used to specify the message time-out time. The message time out will be set to the number stored in this word times 10ms.

Word offsets 12 thru 15 are reserved for future use. Set to 0000H.

Word offset 16 thru 19 are used to specify a Poll Message Error Address. This address will be updated by the Comm-Master at the conclusion of the poll request. The poll request is ended whenever either the RTU responds with the requested data or an error occurs. The error word will be updated with the latest status available to the Comm-Master. The error address fields are defined exactly as described for bytes 6 thru 9 above.

1.6 COMMAND MESSAGE INSTRUCTION

Control commands are sent from the Comm-Master using standard ladder logic MSG instructions. The MSG instruction must be a WRITE command which is addressed to the Comm-Master (the data highway address of the RS-232 interface module that is connected to the Comm-Master). The processor type must be set to PLC-2 and the Local/Remote mode set to LOCAL. The destination data table address is not used and can be set to any (non zero) value. The MSG instruction references a data table address and length. The contents of the data table will be sent to the Comm-Master. The Comm-Master interprets this data to form the actual command that will be sent to the remote device. In most cases, the device that will receive the command will be a MARC Comm-Adapter. The Comm-Adapter will use the data received to control internal functions or to send on to a protocol converter port.

Word offset 0 is used to specify the time out value to be used for the command. This is the amount of time that the Comm-Master will wait for a reply from the Comm-Adapter. The time out value will be 10 msec times the value stored in word 0.

Word offset 1 is used to specify a "linked poll message" and an optional delay. A linked poll message is a poll that is forced after the command is issued. For example, this may be used to immediately read back a status line to confirm that the control action specified in the control command did indeed occur. Byte 0 isused to specify the linked poll number. If no linked poll message is required set byte 0 to 00H. Byte 1 is used to specify an optional delay time. The delay time is specified in 10 msec increments. The delay time is altered by the delay timer multiplier factor stored in the header. If no delay is required set the delay time to 00_H.

Words 2 and 3 are reserved for future use. Set them to 0000_H.

Word 4 is used to specify the Comm-Adapter port number and the Comm-Adapter message type. Valid port numbers are from 1 thru 8. The only valid message types are: 03 Set Timeouts, 04 Download Variables, 05 Reset Ports/Comm-Adapter, 10 Control Request, 100 Set Pass Thru, 101 Reset Pass Thru and 103 Pass Thru Message.

Word 5 is used to specify the RTU address if required. Valid RTU addresses range from 0 thru 255.

Word 6 isused to specify the Data Type that is to be affected by the command. Valid choices are 05 (bit) and 06 (register)

Word 7 is used to specify an address parameter for the remote device. This may be in the form of an address word hi byte, a function code or other address information depending on the type of port that will receive this command.

Word 8 is used to specify another address parameter or data for the remote device. This may be in the form of an address word low byte or the starting address of the data to be affected or the value of a timer or other variable required as part of the command..

1.7 JUMPER SELECTIONS FOR MARC PROTOCOL

The Comm-Master jumper settings and EPROM part numbers for Comm-Master MARC protocol operation is detailed in the following figure.

JUMPER	POSITION	JUMPER	POSITION
J2	1-2	J10	NOT USED
J3	NOT USED	J11	1-2
J4	NOT USED	J12	1-2
J5	NOT USED	J13	NOT USED
J6	1-2	J14	NOT USED
J7	1-2	J15	1-2
J8	NOT USED	J16	NOT USED

MARC Universal Protocol Communication is on Port P1 (top port), Allen-Bradley Communication is on Port P2 (center port)

U13 = # 186-003-1

U23 = not required

Figure 22 Jumper Settings

COMM-MASTER CONFIGURATION HEADER WORKSHEET FOR MARC PROTOCOL

WORD	BYTE	ADDRESS	BYTE0	BYTE1	DESCRIPTION
00	00,01				Comm-Master address; number of Polling tables
01	02,03				Radio turn-on delay (x 10ms)
02	04,05				Radio turn-off delay (x 10ms)
03	06,07		00	01	Reserved
04	08,09				Remote baud rate; # data bits
05	10,11				Remote parity; stop bits
06	12,13		00	00	Reserved
07	14,15		00	00	Reserved
08	16,17		00	00	Reserved
09	18,19		00	00	Reserved
10	20,21				Radiokey Address
11	22,23				Poll Timer Multiplier Factor
12	24,25		00	00	Spare
13	26,27		00	00	Spare
14	28,29		00	00	Spare
15	30,31		00	00	Spare
16	32,33		00	00	Spare
17	34,35		00	00	Spare
18	36,37		00	00	Spare
19	38,39		00	00	Spare

COMM-MASTER POLLING TABLE WORKSHEET FOR MARC PROTOCOL

WORD	BYTE	ADDRESS	BYTE0	BYTE1	DESCRIPTION
00	00,01				Port Address; Comm-Adapter Message Type
01	02,03		00		Number of Bytes
02	04,05		00		**Data Source Address** - Reserved; RTU Addx.
03	06,07		00		Data Type
04	08,09		00		Data Address Offset High
05	10,11		00		Data Address Offset Low
06	12,13				**Data Destination Address**- PLC Type; Address
07	14,15				L.P.; File Type
08	16,17				File Number
09	18,19				Starting Element
10	20,21				Poll Update Frequency (x 10 ms)
11	22,23				Poll Timeout (x 10ms)
12	24,25		00	00	Reserved
13	26,27		00	00	Spare
14	28,29		00	00	Spare
15	30,31		00	00	Spare
16	32,33				**Error Address**-PLC Type; Address
17	34,35				L.P.; File Type
18	36,37				File Number
19	38,39				Starting Element

POLL TABLE

WORD	BYTE	ADDRESS	BYTE0	BYTE1	DESCRIPTION
00	00,01				Port Address; Comm-Adapter Message Type
01	02,03		00		Number of Bytes
02	04,05		00		**Data Source Address** - Reserved; RTU Addx.
03	06,07		00		Data Type
04	08,09		00		Data Address Offset High
05	10,11		00		Data Address Offset Low
06	12,13				**Data Destination Address**- PLC Type; Address
07	14,15				L.P.; File Type
08	16,17				File Number
09	18,19				Starting Element
10	20,21				Poll Update Frequency (x 10 ms)
11	22,23				Poll Timeout (x 10ms)
12	24,25		00	00	Reserved
13	26,27		00	00	Spare
14	28,29		00	00	Spare
15	30,31		00	00	Spare
16	32,33				**Error Address**-PLC Type; Address
17	34,35				L.P.; File Type
18	36,37				File Number
19	38,39				Starting Element

POLL TABLE

COMM-MASTER COMMAND WORKSHEET FOR MARC PROTOCOL

WORD	BYTE	ADDRESS	BYTE0	BYTE1	DESCRIPTION
00	00,01				Message time out (x 10ms)
01	02,03				Linked Poll # ; Linked Poll delay (x 10ms)
02	04,05		00	00	Reserved
03	06,07		00	00	Reserved
04	08,09				Port Number; Comm-Adapter Message Type
05	10,11		00		**Destination Address-** Reserved; RTU Addx.
06	12,13		00		Data Type
07	14,15		00		Data Address Offset high
08	16,17		00		Data Address Offset Low
09	18,19				Start of data

COMMAND

WORD	BYTE	ADDRESS	BYTE0	BYTE1	DESCRIPTION
00	00,01				Message time out (x 10ms)
01	02,03				Linked Poll # ; Linked Poll delay (x 10ms)
02	04,05		00	00	Reserved
03	06,07		00	00	Reserved
04	08,09				Port Number; Comm-Adapter Message Type
05	10,11		00		**Destination Address-** Reserved; RTU Addx.
06	12,13		00		Data Type
07	14,15		00		Data Address Offset high
08	16,17		00		Data Address Offset Low
09	18,19				Start of data

COMMAND

WORD	BYTE	ADDRESS	BYTE0	BYTE1	DESCRIPTION
00	00,01				Message time out (x 10ms)
01	02,03				Linked Poll # ; Linked Poll delay (x 10ms)
02	04,05		00	00	Reserved
03	06,07		00	00	Reserved
04	08,09		00		Reserved; MODBUS Function Code
05	10,11		00		**Destination Address-** Reserved; Address
06	12,13		00	00	Reserved
07	14,15		00	00	Reserved
08	16,17				Starting Register/Coil
09	18,19				Start of data

COMMAND