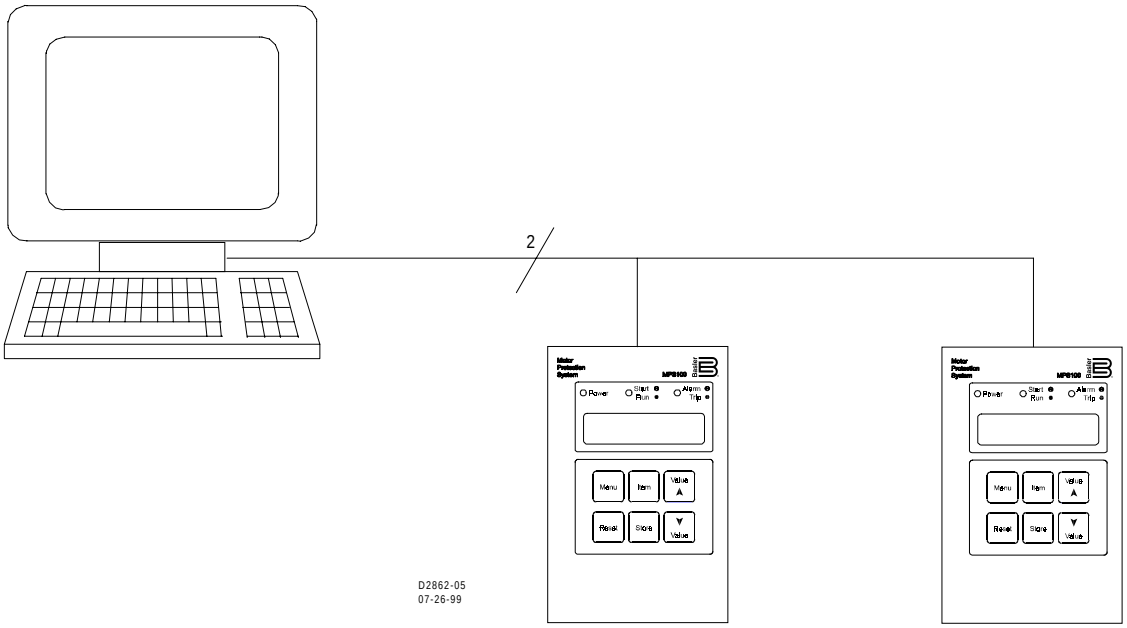
INSTRUCTION MANUAL
for
MPS100
MOTOR
PROTECTION SYSTEMS

MODBUS PROTOCOL



Basler Electric

Publication Number: 9 3254 00 991
Revision: None 07/99

This manual provides detailed communications protocol information for MPS100, Motor Protection Systems with the Modbus™ Protocol.

WARNING

TO AVOID PERSONAL INJURY OR EQUIPMENT DAMAGE, ONLY QUALIFIED PERSONNEL SHOULD PERFORM THE PROCEDURES PRESENTED IN THIS MANUAL.

CAUTION

MEGGERS AND HIGH POTENTIAL TEST EQUIPMENT SHOULD BE USED WITH EXTREME CARE. INCORRECT USE OF SUCH EQUIPMENT COULD DAMAGE COMPONENTS CONTAINED IN THE DEVICE.

First Printing: July,1999

Printed in USA

CONFIDENTIAL INFORMATION
OF BASLER ELECTRIC COMPANY, HIGHLAND, IL. IT IS LOANED FOR CONFIDENTIAL USE, SUBJECT TO RETURN ON REQUEST, AND WITH THE MUTUAL UNDERSTANDING THAT IT WILL NOT BE USED IN ANY MANNER DETRIMENTAL TO THE INTEREST OF BASLER ELECTRIC COMPANY.

It is not the intention of this manual to cover all details and variations in equipment, nor does this manual provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to modification without notice. Should further information be required, contact Basler Electric Company, Highland, Illinois.

BASLER ELECTRIC
ROUTE 143, BOX 269
HIGHLAND, IL 62249 USA
http://www.basler.com, info@basler.com
PHONE 618-654-2341 FAX 618-654-2351

CONTENTS

GENERAL

This publication describes the Modbus™ communications protocol employed by MPS100 Motor Protection System relays, and how to exchange information with MPS100 relays over a Modbus™ network. The MPS100 communicates by emulating a subset of the Modicon 984 Programmable Controller.

Warning

It is important to first connect Ground to the MPS100 Ground Stud before connecting the serial link wires. Ignoring this warning may result in permanent damage to the Serial Link Hardware and can be dangerous.

INTRODUCTION TO MODBUS™ PROTOCOL

Modbus™ communications use a master-slave technique in which only the master can initiate a transaction. This transaction is called a query. When appropriate, a slave (MPS100) responds to the query. When a Modbus™ master communicates with a slave, information is provided or requested by the master.

All supported data can be read as specified in the register table. Abbreviations are used in the *Register Table* to indicate the register type. Register types are:

Read/Write = RW
Read Only = R -

MPS100 MODBUS™ PROTOCOL

When a slave receives a query, the slave responds by either supplying the requested data to the master or performing the requested action. A slave device never initiates communications on the Modbus™, and will always generate a response to the query unless certain error conditions occur. The MPS100 is designed to communicate on the Modbus™ only as a slave device.

A master can only query slaves individually. If a query requests actions unable to be performed by the slave, the slave response message contains an exception response code defining the error detected.

MPS100 Communication Timing Issues

The MPS100 devices will normally respond to a valid request within 40 mS, for a long frame the response could take as long as 200 mS to construct. If the same MPS is queried more than once per second the response may also be delayed. After storing setting parameters the MPS should not be transmitted to again in less than one second to allow the MPS to complete storing parameters within non-volatile memory.

Communication Parameters

The baud rate and device address of the MPS devices can only be set manually and the unit must be powered off and on again for the new values to take affect. The parity is fixed as EVEN, there is one stop bit (fixed) and baudrates may be 1200, 2400, 4800 or 9600 bits per second.

Message Structure

Master initiated queries and MPS100 responses share the same message structure. Each message is comprised of four message fields. They are:

- Device Address
- Function Code
- Data Block
- Error Check field

Device Address Field

The device address field contains the unique Modbus™ address of the slave being queried. The addressed slave repeats the address in the device address field of the response message. This field is 1 byte.

Modbus™ protocol limits a device address from 1 - 247, the MPS100 default value is 248 which is communication OFF condition. Slave address 0, used for broadcast transmissions in Modbus™, is not supported in the MPS100 Motor Protection System products.

Function Code Field

The function code field in the query message defines the action to be taken by the addressed slave. This field is echoed in the response message, and is altered by setting the most significant bit (MSB) of the field to 1 if the response is an error response. This field is 1 byte.

The MPS100 maps all regs into the Modicon 984 holding register address space (4XXXX) and supports the following function codes (MPS use in parenthesis).

- Function 01 - Read Coil Status (Read Discrete Command status)
- Function 02 - Read Input Status (Read Discrete Input status)
- Function 03 - Read Holding Registers (Read Setting Parameters)
- Function 04 - Read Input Registers (Read Actual Data)
- Function 05 - Force Single Coil (Force One Discrete Command)
- Function 06 - Preset Single Register (Write One Setting Parameter)
- Function 08, subfunction 00 - diagnostics: return query data (Loopback Diagnostics)
- Function 15 - Force Multiple Coils (Force Discrete Command)
- Function 16 - Preset Multiple Registers (Write Setting Parameters, non-broadcast)

Data Block Field

The query data block contains additional information needed by the slave to perform the requested function. The response data block contains data collected by the slave for the queried function. An error response will substitute an exception response code for the data block. The length of this field varies with each query. See the paragraphs on *Register Definitions* in this manual for interpretation of reg data.

Error Check Field

The error check field provides a method for the slave to validate the integrity of the query message contents and allows the master to confirm the validity of response message contents. This field is 2 bytes.

Serial Transmission Details

A standard Modbus™ network offers two transmission modes for communication: ASCII or remote terminal unit (RTU). The MPS100 supports only the RTU mode.

Each 8-bit byte in a message contains two 4-bit hexadecimal characters. The message is transmitted in a continuous stream with the LSB of each byte of data transmitted first. Transmission of each 8-bit data byte occurs with one start bit and one stop bit. Parity checking is performed, when enabled, and can be either odd or even. The transmission baud rate is user-selectable, and can be set at installation and altered during real-time operation. The MPS100 supported baud rates are 1200, 2400, 4800, and 9600. The factory set baud rate is 9600. MPS100 supports an RS-485 compatible serial interface.

Message Framing And Timing Considerations

When receiving a message, the MPS100 requires an inter-byte latency of 3.5 character times before considering the message complete. Table 1 provides the response message transmission time (in seconds) and 3.5 character times (in milliseconds) for various message lengths and baud rates.

Table 1. Timing Considerations

Baud Rate	3.5 Character Time (mSec)	Message Tx Time (Sec.)	
		128 Bytes	256 Bytes
300	128.3	4.69	9.39
600	64.2	2.35	4.69
1200	32.1	1.17	2.35
2400	16.04	0.59	1.17
4800	8.021	0.29	0.59
9600	4.0104	0.15	0.29
19200	2.0052	0.07	0.15

Error Handling And Exception Responses

Any query received that contains a non-existent device address, a framing error, or CRC error is ignored. No response is transmitted. Queries addressed to a MPS100 with an unsupported function code, unsupported register references, or illegal values in the data block result in an error response message with an exception response code. The exception response codes supported by the MPS100 are provided in Table 2.

Table 2. Supported Exception Response Codes

Code	Name	Meaning
01	Illegal Function	The query Function/Subfunction Code is unsupported.
02	Illegal Data Address	Data Address is not allowable.
03	Illegal Data Value	One or more data values out of range.
06	MPS Busy	Trying to Preset Multiple Registers while motor is not stopped (Function 16).

COMMUNICATIONS HARDWARE REQUIREMENTS

The MPS100 RS-485 physical interface is three positions of a terminal strip with locations for Data +, Data - and shield. Refer to the MPS100 Owner's Manual for further details.

DETAILED MESSAGE QUERY AND RESPONSE

A detailed description of MPS100 supported message queries and responses is provided in the following paragraphs.

Read Input Registers

Query

This query message requests a register or block of registers to be read. The data block contains the starting register address and the quantity of registers to be read. A register address of N will read holding register N+1.

Device Address	
Function Code	04 (hex)
Starting Address Hi	
Starting Address Lo	
No. of Registers Hi	
No. of Registers Lo	
CRC error check	

The number of registers cannot exceed 120 without causing an error response with the exception code for an illegal function.

Example: Read Actual Parameters 1...3 (I1, I2 & I3 Currents) of MPS #18. Actual registers requested are addressed as 0 ...2, data length = 3, 1 register per phase.

Frame sent to slave address 18, (12h)

Serial Link #	Function Read Input Register	Holding Register Hi	Holding Register Lo	Number of Registers Hi	Number of Registers Lo	CRC H i	CRC Lo
12h	04h	00h	00h	00	03h	xxh	xxh

Response

The response message contains the data queried. The data block contains the block length in bytes followed by the data for each requested reg. For each requested reg, there is one Data Hi and one Data Lo. Attempting to read an unused register or a register which does not support a read results in an error response with the exception code for an illegal data address.

Device Address	
Function Code	04 (hex)
Byte Count	
Data Hi (For each requested reg, there is one Data Hi and one Data Lo.)	
Data Lo	
.	
.	
Data Hi	
Data Lo	
CRC error check	

Example: Assuming that currents are 400, 402 and 398 Amps, respectively.

Slave Response Frame Sent Back to Master

Serial Link #	Function Read Input Register	Byte Count	Data High	Data Low	Data High	Data Low	Data High	Data Low	CRC H i	CRC Lo
12h	04h	06h	01h	90h	01h	92h	01h	8Eh	xxh	xxh

Return Query Data

This query contains data to be returned (looped back) in the response. The response and query messages should be identical.

Device Address	
Function Code	08 (hex)
Subfunction Hi	00 (hex)
Subfunction Lo	00 (hex)
Data Hi	
Data Lo	
CRC error check	

Example: Loopback Message

Frame Sent To Slave Address 125 , (7dh)

Serial Link #	Function Loopback	Diagnostic Code Hi	Diagnostic Code Lo	Data Hi	Data Lo	CRC H i	CRC Lo
7dh	08h	00	00	a5h	5ah	10h	9ch

Frame Returned To Master

Serial Link #	Function Loopback	Diagnostic Code Hi	Diagnostic Code Lo	Data Hi	Data Lo	CRC H i	CRC Lo
7dh	08h	00	00	a5h	5ah	10h	9ch

Preset Multiple Registers

A preset multiple registers query could address multiple registers in one slave or multiple slaves.

Query

A query message requests a register or block of registers to be written. The data block contains the starting address and the quantity of registers to be written, followed by the Data Block byte count and data. The MPS100 will perform the write when the device address is the same as the MPS 100s remote address or when the device address is 0. A device address is 0 for a broadcast query.

A register address of N will write Holding Register N+1.

No data will be written if any of the following exceptions occur.

- Queries to write to Read Only or unsupported registers result in an error response with Exception Code of Illegal Data Address.
- Queries attempting to write more than 100 registers cause an error response with Exception Code Illegal Function.

- An incorrect Byte Count will result in an error response with Exception Code of “Illegal Data Value.
- A query to write which is not preceded by a valid Password Clearance query results in an error response with Exception Code of “Illegal Function.
- There are several instances of registers that are grouped together to collectively represent a single numerical (vs. ASCII string) MPS100 reg value (DP, FP, TP). A query to write a subset of such a register group will result in an error response with Exception Code “Illegal Data Address.
- A query to write an unallowed value (out of range) to a register results in an error response with Exception Code of “Illegal Data Value.

Device Address	
Function Code	10 (hex)
Starting Address Hi	
Starting Address Lo	
No. of Registers Hi	
No. of Registers Lo	
Byte Count	
Data Hi	
Data Lo	
.	
.	
Data Hi	
Data Lo	
CRC Error Check	

Response

The response message echoes the starting address and the number of registers. There is no response message when the query is broadcast.

Device Address	
Function Code	10 (hex)
Starting Address Hi	
Starting Address Lo	
No. of Registers Hi	
No. of Registers Lo	
CRC Error Check	

CRC Error Check

This field contains a two-byte CRC value for transmission error detection. The master first calculates the CRC and appends it to the query message. The MPS100 recalculates the CRC value for the received query and performs a comparison to the query CRC value to determine if a transmission error has occurred. If so, no response message is generated. If no transmission error has occurred, the slave calculates a new CRC value for the response message and appends it to the message for transmission.

The CRC calculation is performed using all bytes of the device address, function code and data block fields. A 16-bit CRC-register is initialized to all 1's. Then each eight-bit byte of the message is used in the following algorithm:

First, exclusive-OR the message byte with the low-order byte of the CRC-register. The result, stored in the CRC-register, will then be right-shifted eight times. The CRC-register MSB is zero-filled with each shift. After each shift, the CRC-register LSB is examined. If the LSB IS a 1, the CRC-register is then exclusive-ORed with the fixed polynomial value A001 (hex) prior to the next shift. Once all bytes

of the message have undergone the above algorithm, the CRC-register will contain the message CRC value to be placed in the error check field.

MAPPING MPS MEMORY INTO MODICON ADDRESS SPACE

Conventions

The MPS 200 and 210 memory is organized according to the common Modbus™ addresses as follows:

Modbus™ Memory Type	MPS Use	Number of Parameters
3X Registers	Actual Data	70 Registers, 1 ... 70
4X Registers	Setting Parameters	78 Registers, 1 ... 78
1X Registers	Hardwired Control Inputs	16 Inputs, 1 ... 16
0X Registers	Discrete Serial Commands	16 Coils, 1 ... 16

Register Tables

The following tables list the parameters based upon memory type. Included in the tables are ranges and defaults values if available.

NOTE

Query address n will access the holding register n+1.

Actual Data (3X References)

Actual Data includes measured values such as Voltages, Currents and Power. It also includes Calculated, Logic and Statistical information. All parameters are word (two byte) parameters. The protocol supports Read Only operations on these parameters.

Parameter #s are "1-based." The actual address is one lower than the Modbus™ register #. For example the address of Actual Data #1 is 0 (30000). The parameters have 3X and 4X mappings.

Modbus™ Register (3X)	(4X)	Parameter	Read/Write Supported	Range	Notes
1	257	IA	R -	Amp.	Phase A Line Current
2	258	IB	R -	Amp.	Phase B Line Current
3	259	IC	R -	Amp.	Phase C Line Current
4	260	IG	R -	Amp.	Ground Current
5	261	Reserved	R -		
6	262	Trips	R -		OR of all trips. Bit spec: d0: momentary, d1:latched, d2..d15 reserved
7	263	Alarms	R -		OR of all alarms. Bit spec: d0: momentary, d1: latched, d2..d15: reserved
8	264	Time_To_Trip	R -	sec.	Estimate time to trip. 64000 means: No trip expected
9	265	Time_To_Start	R -		sec. Estimate time to start.
10	266	Average_RMS_Current	R -	Amp	Average of the 3 line currents.
11	267	Motor_Load	R -		Average current - % of FLC
12	268	Unbalance	R -		Unbalance current
13	269	Alarm_Fault_Number	R -		Fault that caused alarm indication (see fault list starting at parameter # 50)
14	270	Frequency_10	R -	Hz	10 * frequency
15	271	Ph_Seq	R -		1- correct phase seq. <> 1 wrong ph. seq
16	272	Resistance	R -		Tenth deg. C
17	273	Control_In	R -		Control Input byte: d15..d2: Reserved d1: Ctrl_in_2 (0=open, 1=closed) d0: Ctrl_in_1 (0=open, 1=closed)
18	274	Current_Fluctuation	R -		I fluctuation, 1/20%. (10000 = not tested now)
19	275	Reserved	R -		
20	276	Reserved	R -		
21	277	Total_Run_Time	R -		Total hours of running motor
22	278	Total_Starts	R -		Total number of starts
23	279	Total_Trips	R -		Total number of fault trips
24	280	Thermal_Capacity	R -		% of thermal capacity used
25	281	Trip_Fault_Number	R -		Fault that caused trip indication (See fault list starting at parameter # 38)

Modbus™ Register (3X)	(4X)	Parameter	Read/Write Supported	Range	Notes
26	282	Logic_Status	R -		Logic status of MPR6.1 indicates: d15..d8: Reserved d7: Trip d6: Alarm d5: Running d4: Starting d3: Stopped d2..do Reserved
27	283	Pre_Trip_I1	R -		Line 1 current value just before trip
28	284	Pre_Trip_I2	R -		Line 2 current value just before trip
29	285	Pre_Trip_I3	R -		Line 3 current value just before trip
30	286	Pre_Trip_I0	R -		Ground current value just before trip
31	287	Last_Start_Period	R -		.01 sec Last start time duration
32	288	Last_Start_Peak_I	R -		Last start peak RMS current
33..37	289..293	Reserved	R -		
38	294	Max_Start_Time	R -		Fault no. 1
39	295	Too_Many_Starts	R -		Fault no. 2
40	296	U/C_Level_1	R -		Fault no. 3
41	297	U/C_Level_2	R -		Fault no. 4
42	298	Load_Increased	R -		Fault no. 5
43	299	O/C Level_1	R -		Fault no. 6
44	300	O/C Level_2	R -		Fault no. 7
45	301	Thermal_Level_1	R -		Fault no. 8
46	302	Thermal_Level_2	R -		Fault no. 9
47	303	Unbalance_Level_1	R -		Fault no. 10
48	304	Unbalance_Level_2	R -		Fault no. 11
49	305	Phase_Sequence	R -		Fault no. 12
50	306	Gnd_Fault_Level_1	R -		Fault no. 13
51	307	Gnd_Fault_Level_2	R -		Fault no. 14
52	308	Comm_Port_Failed	R -		Fault no. 15
53	309	Internal Failure	R -		Fault no. 16
54	310	External_Fault_1	R -		Fault no. 17
55	311	External_Fault_2	R -		Fault no. 18
56	312	Temp_Level_1	R -		Fault no. 19
57	313	Temp_Level_2	R -		Fault no. 20
58	314	Unstable_Current	R -		Fault no. 21
59..70	315..334	Reserved	R -		

Setting Parameters (4X Registers)

Setting Parameters include all registers which can be set manually. These parameters determine the modes of operation of the MPS. They also set protection levels. All parameters are word (two byte) in length. The protocol supports reading and writing of (most of) these registers.

> **NOTE**
>
> Any of these registers must be set with care. Harmful results can occur to the motor by inadequate settings of some parameters.

Parameter	#	Range	Default
Page 0 – System Parameters Settings			
Line_Frequency	1	50/60 Hz	60 Hz
Motor_FLC	2	1..2000	100 (Amp)
CT_Primary	3	1..2000	100 (Amp)
Gnd_CT_Primary	4	1..2000	100 (Amp)
Trip_Inhibit	5	40..100 and 250 (-10%)	250 (Off)
Config_Trip_Relay	6	0 – Trip, 1 – Trip-Fail Safe	
Config_Input_1	7	0 – Reset, 1 – Ext Fault 1 N/O (Closed = Fault) 2 – Ext Fault 1 N/C (Open = Fault)	
Config_Input_2	8	0 – Reset, 1 – Ext Fault 2 N/O (Closed = Fault) 1 – Ext Fault 2 N/C (Open = Fault)	
Parameters_Lock	9	0 – No, 1- Yes	
Motor_Number	10	0..320	0
Address_Number	11	1..247 and 248(Off)	248(to lock out)
Baud_Rate	12	12/24/48/96(*100)	96=9600 baud
Reserved	13..16		

Parameter	#	Range	Default
Page 1 – Protection Parameter Settings			
Max_Start_Time	17	1..250 Sec.	10 (Sec.)
Number_Of_Starts	18	1..10	10
Starts_Period	19	1..60 min	30 (min)
#St Auto Rst Dly	20	1..60 min	15 (min)
U/C_Level_1	21	10..90% FLC	50 (%of FLC)
U/C_Level_1_Delay	22	1..60 Sec	2 (Sec)
U/C_Level_2	23	10..90 % of FLC	40 (% of FLC)
U/C_Level_2_Delay	24	1..60 Sec.	5 (Sec.)
Load_Increase	25	60..150 % of FLC	120 (% of FLC)
O/C_Level_1	26	10..50 (*10% FLC)	40 (4 FLC)
O/C_Level_1_Delay	27	5..100 (*0.1 Sec.)	20 (2 Sec.)
O/C_Level_2	28	40..120 (*10% of FLC)	80 (8 FLC)
O/C_Level_2_Delay	29	0..40 (*0.1 Sec.)	5 (0.5 Sec.)
Overload Pickup	30	60..130 % of FLC	105 (% of FLC)
Thermal_Level_1	31	50..99 % of thermal cap.	80 (%)
T6x_Time	32	1..240 (*0.5 Sec.)	20 (10 Sec.)

Parameter	#	Range	Default

Page 1 – Protection Parameter Settings (Continued)

Hot_Cold_Ratio	33	20..100%	50 (%)
Cool_Time_Factor	34	1..15	5
Unbalance_Level_2	35	10..40	15 (%)
Unbal_Level_2_Max_Time	36	20..120 Sec.	30 (Sec.)
Gnd_Fault_Level_1	37	1..100%	5 (% of FLC)
G/F_Level_1_Delay	38	0..20 (0 – 2 Sec)	10 (Sec)
Gnd_Fault_Level_2	39	1..100%	10 (% of FLC)
G/F_Level_2_Delay	40	0..20 (0 – 1Sec)	5 (0.5 Sec)
Thermistor_Type	41	0 – NTC, 1 – PTC	1 (PTC)
Thermistor_Lvl_1	42	100..30000 Ohms	3000 (Ohms)
Thermistor_Lvl_2	43	100..30000 Ohms	4000 (Ohms)
Unstable_Current	44	1..10 (*10% of FLC)	5(% of FLC)
Reserved	45..48		

Parameter	#	Range	Default

Page 2 – Tripping / Alarm Options

For each of the following setup bytes, every bit has a special function:

d15..d8: Reserved
d7: Trip
d6: Alarm
d5: Auto Reset
d4: Operate Relay C
d3: Operate Relay D
d2..d0: Reserved

For each bit: 0 = Disabled, 1 = Enabled.

Max_Start_Time_Setup	49	$40
Too_Many_Starts_Setup	50	$0
U/C_Level_1_Setup	51	$40
U/C_Level_2_Setup	52	$0
Load_Increased_Setup	53	$40
O/C_Level_1_Setup	54	$C0
O/C_Level_2_Setup	55	$C0
Thermal_Level_1_Setup	56	$40
Thermal_Level_2_Setup	57	$C0
Unbalance_Level_1_Setup	58	$40
Unbalance_Level_2_Setup	59	$C0
Phase_Sequence_Setup	60	$C0
Gnd_Fault_Level_1_Setup	61	$40
Gnd_Faul_Level_2_Setup	62	$C0
Comm_Port_Failed_Setup	63	$20
Internal_Failure_Setup	64	$40
External_Fault_1_Setup	65	$0
External_Fault_2_Setup	66	$0
Thermistor_Lvl_1_Setup	68	$0
Thermistor_Lvl_2_Setup	69	$0
Reserved	70..78	

Notes:

1. Parameter # is “1-based.” The address is one lower that the parameter #. For example, address of parameter #1 is 0 (40000).

2. For all Setpoints, it is important to use values within the listed limits.
   Care must be taken when Preset Single / Multiple Register Functions (06 / 16) are used to adjust one or more setting parameters. Harmful results may occur by setting one or more parameters incorrectly or out of the specified range.

3. Preset of one setting parameter (using Function 06) can be done at any time.
   Preset of one or more setting parameters (using Function 16) can be performed only when the motor is stopped. Exception response (06 = Busy) is returned by the MPS if an attempt to write setting parameters is done while the motor is running (not stopped).

4. After storing setting parameters (using Function 16), it is prohibited to transmit again to the same MPS in less than one second.

5. Communication parameters 11 & 12 can only be read through the serial link. They can be preset only manually.

6. It is the user’s responsibility to read and check all changed setting parameters after presetting.

7. It is never allowed to read more than 64 Setting Parameters together in one request.

Discrete Commands (Coils, 0x Registers)

The MPS incorporates 16 “Coils” (bit parameters) from which only one (1) is operative. The other 15 are reserved and are incorporated to enable using word (16 bit) type parameters. Coil number is “1 based.” The actual address is one lower than the coil #. For example, coil #1 is addressed as 0 (00000). The coils have the following 0x references.

Modbus™ Register	Parameter	Read/Write Supported	Range	Default
1	Reserved			
2	Reserved			
3	Reserved			
4	Reserved	R W		
5	Reserved	R W		
6	Reserved	R W		
7	Reserved	R W		
8	Coil 8, Reset		Write “1” (ON) to Reset	
9	Reserved	R W		
10	Reserved	R W		
11	Reserved	R W		
12	Reserved	R W		
13	Reserved	R W		
14	Reserved	R W		
15	Reserved	R W		
16	Reserved	R W		

Discrete Hardwired Inputs (1x Registers)

The MPS incorporates 16 Discrete Inputs (bit parameters) of which only 2 are operative. The other 14 are reserved and were included to enable using a word (16 bit) parameter. The input number is "1 based." The actual address is one lower than the input #. For example, input #1 is addressed as 0 (10000). The inputs have the following 1x references.

Modbus™ Input	Parameter	Read/Write Data Supported	Range	Comment
1	Input_1, Start A	R		Local Start A ("1" = start)
2	Input_2, Start B	R		Local Start B ("1" = star
0003	Reserved	R		
.				
.				
.				
0014	Reserved	R		

Notes:

1. In the Modbus™ Input list above, Closed input reads "1," open input reads "0."
2. Hardwired Inputs 1 ... 2 discussed here can also be analyzed from Actual Parameter 17, Control_In_1. Note, however, that for the Contro_In_ parameter "0" indicated closed contact while here in this section "1" indicates closed contacts.