

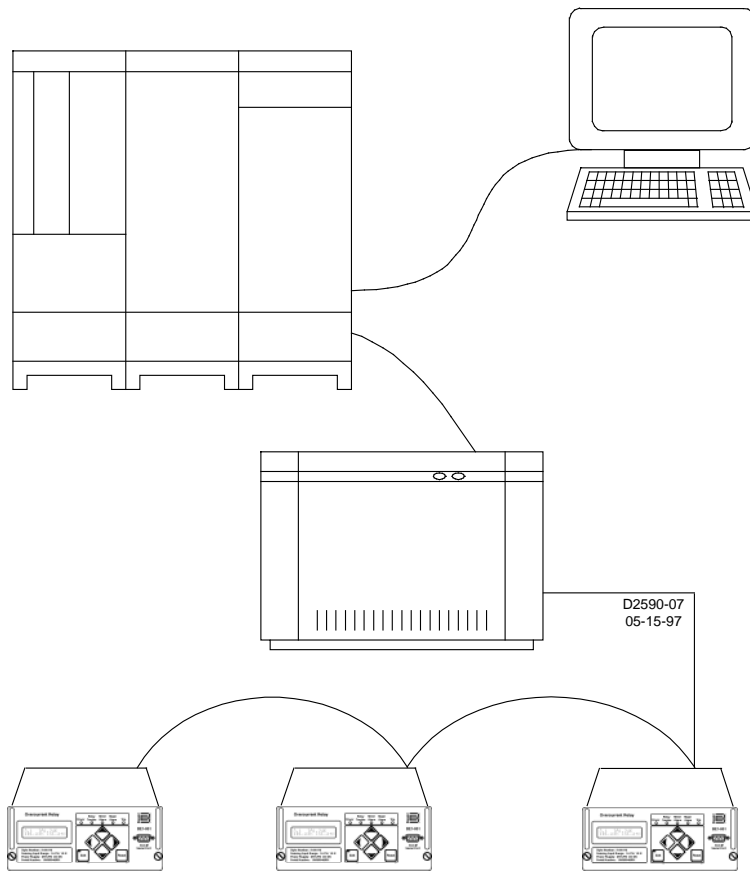
# INSTRUCTION MANUAL

FOR

## PSS-100

### POWER SYSTEM STABILIZER

### MODBUS<sup>®</sup> PROTOCOL



 **Basler Electric<sup>®</sup>**

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## INTRODUCTION

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This manual provides detailed communications protocol information for the PSS-100 Power System Stabilizer with Modbus communication protocol.

### **WARNING!**

To avoid personal injury or equipment damage, only qualified personnel should perform the procedures presented in this manual.

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**WARNING!**

**READ THIS MANUAL.** Read this manual before installing, operating, or maintaining the PSS-100. Note all warnings, cautions, and notes in this manual as well as on the product. Keep this manual with the product for reference. Only qualified personnel should install, operate, or service this system. Failure to follow warning and cautionary labels may result in personal injury or property damage. Exercise caution at all times.

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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. Over time, improvements and revisions may be made to this publication. Before performing any of the following procedures, contact Basler Electric for the latest revision of this manual.

The English-language version of this manual serves as the only approved manual version.

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## MANUAL REVISION HISTORY

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The following information provides a historical summary of the changes made to this manual. All revisions are listed in chronological order.

Revision /Date	Change
–, 08/01	<ul style="list-style-type: none"><li>• Initial Release</li></ul>
A, 04/03	<ul style="list-style-type: none"><li>• Added register definitions for PSS Motor/Phase Sequence mode.</li><li>• Added SL-OP command to ASCII command/register cross-reference.</li></ul>
B, 08/17	<ul style="list-style-type: none"><li>• Added caution statement about nonvolatile memory</li></ul>

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## GENERAL DESCRIPTION

This document describes the Modbus® communications protocol employed by PSS-100 Power System Stabilizers, and how to exchange information with PSS-100 units over a Modbus network. The PSS-100 communicates by emulating a subset of the Modicon 984 Programmable Controller.

### CAUTION

This product contains one or more *nonvolatile memory* devices. Nonvolatile memory is used to store information (such as settings) that needs to be preserved when the product is power-cycled or otherwise restarted. Established nonvolatile memory technologies have a physical limit on the number of times they can be erased and written. In this product, the limit is 100,000 erase/write cycles. During product application, consideration should be given to communications, logic, and other factors that may cause frequent/repeated writes of settings or other information that is retained by the product. Applications that result in such frequent/repeated writes may reduce the useable product life and result in loss of information and/or product inoperability.

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## FUNCTIONAL DESCRIPTION

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 (PSS-100) responds to the query. When a Modbus master communicates with a slave, information is provided or requested by the master. Information residing in the PSS-100 is grouped categorically as follows:

### Category

Session Parameters  
Global Parameters  
Control Parameters (Select Before Operate)  
Setting Parameters  
Report Parameters  
Metering Parameters

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 -

Select Before Operate (SBO) functions are used to change active settings groups and control outputs. There are four settings groups in the PSS-100, one of which may be selected as active using SBO commands.

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 PSS-100 is designed to communicate on the Modbus only as a slave device.

A master can query slaves individually or universally. A universal (“broadcast”) query, when allowed, evokes no response from any slave device. If a query to an individual slave device requests actions unable to be performed by the slave, the slave response message contains an exception response code defining the error detected. Exception response codes are quite often enhanced by the information found in the “Error Details” block of holding registers.

### Message Structure

Master initiated queries and PSS-100 responses share the same message structure. Each message is comprised of four message fields. They are:

- Device Address (1 byte)
- Function Code (1 byte)
- Data Block (n bytes)
- Error Check field (2 bytes)

### 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.

Although Modbus protocol limits a device address from 1 - 247, a PSS-100 can be assigned a device address in the range of 1 - 65534. The address is user-selectable at installation, and can be altered during real-time operation.

### 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 PSS-100 maps all available data into the Modicon 984 holding register address space (4XXXX) and supports the following function codes.

- Function 03 (03 hex) - read holding registers
- Function 06 (06 hex) - preset single register (write single holding register)
- Function 08 (08 hex), subfunction 00 - diagnostics: return query data
- Function 08 (08 hex), subfunction 01 - diagnostics: restart communications option
- Function 08 (08 hex), subfunction 04 - diagnostics: force listen-only mode
- Function 16 (10 hex) - preset multiple registers, non-broadcast and 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 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 PSS-100 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 either one or two stop bits. 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 PSS-100 Modbus supported baud rates are 1200, 2400, 4800, 9600, and 19200. The factory default baud rate is 9600.

PSS-100 supports both RS-232-C and RS-485 compatible serial interfaces. Both interfaces are accessible from the rear panel of the PSS-100. The RS-232-C interfaces (front and rear) are configured for ASCII command mode while the RS-485 interface is configured for Modbus communication, when this option is installed. The tenth character of the relay style number must be '1' for the relay to be configured for Modbus.

## **Message Framing and Timing Considerations**

When receiving a message, the PSS-100 requires an inter-byte latency of 3.5 character times before considering the message complete.

Once a valid query is received, the PSS-100 waits a specified amount of time before responding. This time delay is set in the remote delay time parameter with the SG-COM ASCII command. This parameter contains a value from 10 - 200 milliseconds. The default value is 10 milliseconds.

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 in Milliseconds	Message Tx Time (Sec.)	
		128 Bytes	256 Bytes
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

A received query is ignored when it contains a non-existent device address, a framing error, or CRC error. No response is transmitted. Queries addressed to a PSS-100 with an unsupported function 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 PSS-100 are provided in Table 2.

Table 2. Supported Exception Response Codes

Code	Name	Meaning
01	Illegal Function	The query Function/Subfunction Code is unsupported; query read of more than 125 registers; query preset of more than 100 registers
02	Illegal Data Address	A register referenced in the data block does not support queried read/write; query preset of a subset of a numerical register group.
03	Illegal Data Value	A preset register data block contains an incorrect number of bytes or one or more data values out of range.

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## COMMUNICATIONS HARDWARE REQUIREMENTS

The PSS-100 RS-485 physical interface is three positions of a terminal strip with locations for Send/Receive A (A), Send/Receive B (B) and Signal Ground (C). Refer to the PSS-100 Instruction Manual (9 3139 00 990) for further details.

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## DETAILED MESSAGE QUERY AND RESPONSE

A detailed description of PSS-100 supported message queries and responses is provided in the following paragraphs.

### Read Holding 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. If the query is a broadcast (device address = 0), no response message is returned.

Device Address

Function Code = 03 (hex)

Starting Address Hi

Starting Address Lo

No. of Registers Hi

No. of Registers Lo

CRC Hi error check

CRC Lo error check

The number of registers cannot exceed 125 without causing an error response with the exception code for an illegal function.

### Response

The response message contains the data queried. The data block contains the block length in bytes followed by the data (one Data Hi byte and one Data Lo byte) for each requested register.

Reading an unassigned holding register returns a value of zero.

Device Address  
Function Code = 03 (hex)  
Byte Count  
Data Hi (For each requested register, there is one Data Hi and one Data Lo.)  
Data Lo  
.  
.  
Data Hi  
Data Lo  
CRC Hi error check  
CRC Lo error check

### **Return Query Data**

This query contains data to be returned (looped back) in the response. The response and query messages should be identical. If the query is a broadcast (device address = 0), no response message is returned.

Device Address  
Function Code = 08 (hex)  
Subfunction Hi = 00 (hex)  
Subfunction Lo = 00 (hex)  
Data Hi = xx (don't care)  
Data Lo = xx (don't care)  
CRC Hi error check  
CRC Lo error check

### **Restart Communications Option**

This query causes the remote communications function of the PSS-100 to restart, terminating an active listen-only mode of operation. No effect is made upon primary relay operations. Only the remote communications function is effected. If the query is a broadcast (device address = 0), no response message is returned.

If the PSS-100 receives this query while in the listen-only mode, no response message is generated. Otherwise, a response message identical to the query message is transmitted prior to the communications restart .

Device Address  
Function Code = 08 (hex)  
Subfunction Hi = 00 (hex)  
Subfunction Lo = 01 (hex)  
Data Hi = xx (don't care)  
Data Lo = xx (don't care)  
CRC Hi error check  
CRC Lo error check

### **Listen Only Mode**

This query forces the addressed PSS-100 to the listen-only mode for Modbus communications, isolating it from other devices on the network. No responses are returned.

While in the listen-only mode, the PSS-100 continues to monitor all queries. The PSS-100 does not respond to any other query until the listen-only mode is removed. All write requests with a query to Preset Multiple Registers (Function Code = 16) are also ignored. When the PSS-100 receives the restart communications query, the listen-only mode is removed.

Device Address  
Function Code = 08 (hex)  
Subfunction Hi = 00 (hex)  
Subfunction Lo = 04 (hex)  
Data Hi = xx (don't care)  
Data Lo = xx (don't care)  
CRC Hi error check  
CRC Lo error check

### **Preset Multiple Registers**

A preset multiple registers query could address multiple registers in one slave or multiple slaves. If the query is a broadcast (device address = 0), no response message is returned.

#### Query

A Preset Multiple Register 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 PSS-100 will perform the write when the device address is the same as the PSS-100's 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.

Data will cease to be written if any of the following exceptions occur.

- Queries to write to Read Only 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".
- There are several instances of registers that are grouped together to collectively represent a single numerical PSS-100 data value (i.e., floating point data and 32-bit integer data). 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 Hi error check  
CRC Lo error check

#### Response

The response message echoes the starting address and the number of registers. There is no response message when the query is a broadcast (device address = 0).

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

### Preset Single Register (Write Single Holding Register)

A Preset Single Register query message requests a single register to be written. The PSS-100 will perform the write when the device address is the same as the PSS-100's remote address.

#### Query

Data will cease to be written if any of the following exceptions occur.

- Queries to write to Read Only registers result in an error response with Exception Code of "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 = 06 (hex)  
Address Hi  
Address Lo  
Data Hi  
Data Lo  
CRC Hi error check  
CRC Lo error check

#### Response

The response message echoes the Query message after the register has been altered.

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## DATA FORMATS

PSS-100 data varies from one to four bytes in length. Single byte data resides in the holding register least-significant byte with the most-significant byte set to zero. Floating point data and long integer data (each 32-bits in length) place the two most-significant bytes in the higher holding register address of the associated register pair.

### Floating Point Data Format (FP)

The Modbus floating point data format uses two consecutive holding registers to represent a data value. The first register contains the low-order 16 bits of the following 32 bit format:

- MSB is the sign bit for the floating point value (0 = positive).
- The next 8 bits are the two's complement exponent biased by 127 decimal.
- The 23 LSBs comprise the normalized mantissa. The most-significant bit of the mantissa is always assumed to be 1 and is not explicitly stored, yielding an effective precision of 24 bits.

The value of the floating point number is obtained by multiplying the binary mantissa times two raised to the power of the unbiased exponent. The assumed bit of the binary mantissa has the value of 1.0, with the remaining 23 bits providing a fractional value. Table 3 shows the floating point format.

*Table 3. Floating Point Format*

Sign	2's Complement Of (Exponent + 127)	Mantissa
1 Bit	8 Bits	23 Bits

The floating point format allows for values ranging from approximately  $8.43 \times 10^{-37}$  to  $3.38 \times 10^{38}$ . A floating point value of all zeroes is the value zero. A floating point value of all ones (not a number) signifies a value currently not applicable or disabled.

Example: The value 95,800 represented in floating point format is hexadecimal 47BB1C00. This number will read from two consecutive holding registers as follows:

<u>Holding Register</u>	<u>Value</u>
K (Hi Byte)	hex 1C
K (Lo Byte)	hex 00

K+1 (Hi Byte)	hex 47
K+1 (Lo Byte)	hex BB

The same byte alignments are required to write.

### Long Integer Data Format (LI)

The Modbus long integer data format uses two consecutive holding registers to represent a 32 bit data value. The first register contains the low-order 16 bits and the second register contains the high-order 16 bits.

Example: The value 95,800 represented in long integer format is hexadecimal 0x00017638. This number will read from two consecutive holding registers as follows:

<u>Holding Register</u>	<u>Value</u>
K (Hi Byte)	hex 76
K (Lo Byte)	hex 38
K+1 (Hi Byte)	hex 00
K+1 (Lo Byte)	hex 01

The same byte alignments are required to write.

### Integer Data Format (INT)

The Modbus integer data format uses a single holding register to represent a 16 bit data value.

Example: The value 4660 represented in integer format is hexadecimal 0x1234. This number will read from a holding register as follows:

<u>Holding Register</u>	<u>Value</u>
K (Hi Byte)	hex 12
K (Lo Byte)	hex 34

The same byte alignments are required to write.

### Short Integer Data Format (SI)

The Modbus short integer data format uses a single holding register to represent an 8 bit data value. The holding register high byte will always be zero.

Example: The value 132 represented in short integer format is hexadecimal 0x84. This number will read from a holding register as follows:

<u>Holding Register</u>	<u>Value</u>
K (Hi Byte)	hex 00
K (Lo Byte)	hex 84

The same byte alignments are required to write.

### ASCII Character Data Format (ASC(1))

The Modbus ASCII character data format uses a single holding register to represent a single character value. The holding register high byte will always be zero with the ASCII character code in the low byte.

Example: The character 'D' represented in ASCII character format is hexadecimal 44. This number will read from a holding register as follows:

<u>Holding Register</u>	<u>Value</u>
K (Hi Byte)	hex 00
K (Lo Byte)	hex 44

The same byte alignments are required to write.

### ASCII String Data Format (ASC(x))

The Modbus ASCII string data format uses one or more holding registers to represent a sequence, or string, of character values. If the string contains a single character, the holding register high byte will contain the ASCII character code and the low byte will be zero.

Example: The string "PASSWORD" represented in ASCII string format will read as follows:

<u>Holding Register</u>	<u>Value</u>
K (Hi Byte)	'P'
K (Lo Byte)	'A'
K+1 (Hi Byte)	'S'
K+1 (Lo Byte)	'S'
K+2 (Hi Byte)	'W'
K+2 (Lo Byte)	'O'
K+3 (Hi Byte)	'R'
K+3 (Lo Byte)	'D'

Example: If the above string is changed to "P", the new string will read as follows:

<u>Holding Register</u>	<u>Value</u>
K (Hi Byte)	'P'
K (Lo Byte)	hex 00
K+1 (Hi Byte)	hex 00
K+1 (Lo Byte)	hex 00
K+2 (Hi Byte)	hex 00
K+2 (Lo Byte)	hex 00
K+3 (Hi Byte)	hex 00
K+3 (Lo Byte)	hex 00

The same byte alignments are required to write.

### Bit Mapped Data Format (BM(x))

The bit mapped data format uses two or more holding registers to represent a sequence of bit values. The Modbus Bit Map data format can represent an 8 bit, 16 bit, 32 bit or 64 bit value.

Example: The Bit Map value of the hexadecimal number 0x123456789ABCDEF0 using a BM64 format will read as follows:

<u>Holding Register</u>	<u>Value</u>
K (Hi Byte)	0x12
K (Lo Byte)	0x34
K+1 (Hi Byte)	0x56
K+1 (Lo Byte)	0x78
K+2 (Hi Byte)	0x9A
K+2 (Lo Byte)	0xBC
K+3 (Hi Byte)	0xDE
K+3 (Lo Byte)	0xF0

### 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 PSS-100 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.

## Template Registers

The PSS-100 uses two templates. A template is a block of holding registers to which the user assigns one of a number of similar groups of parameters. Templates are used for settings groups and report generation.

The PSS-100 has four settings groups. The GRP template is assigned the parameters of a settings group. Therefore, before reading or writing settings group values, a user must first specify which settings group is to be associated with the template. This is accomplished by writing the desired settings group number (0-3) into the SETTINGS GROUP SELECTION Template holding register.

The PSS-100 generates 10 ASCII reports. The RPT template is assigned the text of a report. Therefore, before reading report text, a user must first specify which report is to be associated with the template. This is accomplished by writing the desired report number into the REPORT SELECTION Template holding register along with the associated report identifier, if any, into the REPORT FOCUS Template holding register.

## Report Generation Registers

The PSS-100 generates numerous ASCII reports available via serial commands. Several of these reports are available intact via the Modbus communication port. The desired report is first specified by writing the REPORT SELECTION holding register. If the report requires a number to be specified, such as a fault number or number of events, that number is written into the REPORT FOCUS holding register. The report is then available via the RPT template. The report can be read from 1 to 125 registers at a time, with each register containing 2 ASCII characters of information. The report-read queries can be interspersed among other query types. The RPT template is continually re-read until the report has completed. Once the report is complete, reading from the RPT template will continually return the ASCII character code of 127 ("7F" hexadecimal). The report cannot be re-read or another report read until the REPORT SELECTION holding register is re-written.

## Contiguous Poll Block Registers

The user may allocate up to 125 holding registers to the Contiguous Poll Block (49875-999). This allocation allows dispersed registers which are frequently read to be polled via a single read query. A register is assigned to a position in the Poll Block by writing its address value into the corresponding position in the Contiguous Poll Block Assignments registers (40746-870). Writing a zero value leaves that Poll Block position unassigned. Once assignments are made, the values of the assigned registers may be read by polling the Contiguous Poll Block. Polling an unassigned position will return a value of zero.

For example, if you wanted to continuously monitor the Date (47364), Time (47365-66), Current Active Group Setting (47373) and PSS Control (40277) Holding Registers, you would first configure the Contiguous Poll Block Registers by writing the desired register address values 7364, 7365, 7366, 7373 and 277 into the Contiguous Poll Block Assignment registers 40746 through 40750, respectively. You may now begin monitoring the specified registers by reading the first 5 locations in the Contiguous Poll Block; i.e., reading register 49875 for the Date (as specified in its corresponding assignment register 40746), reading register 49876 and 77 for the Time (as specified in their corresponding assignment registers 40747 and 48), reading register 49878 for the Current Active Group Setting (as specified in its corresponding assignment register 40749), and reading register 49879 for the PSS Control (as specified in its corresponding assignment register 40750).

## Exception Code Enhancement Registers

When a PSS-100 responds to a Preset Multiple Register query with an error response message, additional information detailing the cause of the error may be available in the ERROR DETAILS block of holding registers (49835-54). The information is in ASCII format and available by reading the message string from the ERROR DETAILS block. The message remains available until the next Preset Multiple Register query is executed unless that query is to the FAULT SELECTION Template holding register. Since this register can be written automatically and randomly in time, the ERROR DETAILS block will not be updated.

The ERROR DETAILS block will also contain the exit status following a Preset Multiple Register query to the EXIT (40001) register. You may clear the ERROR DETAILS message at any time without affecting system operation by sending a Preset Multiple Register query to any unassigned holding register.

## MAPPING PSS-100 PARAMETERS INTO MODICON HOLDING REGISTER ADDRESS SPACE

### General

Parameters are mapped into the holding register address space (40001 – 49999) in blocks according to access type.

Any Holding Register not listed in the Register Table is an unassigned Holding Register. A value of zero always results when reading an unassigned Holding Register. Writes to unassigned Holding Registers are legal, but no action will be taken (the write is ignored).

### Conventions

The Data Format column uses the following abbreviations.

ASC(x) - ASCII string, where x = the maximum defined string length

BM(x) - Bit-map, where x = the number of related bits

FP - Floating point

INT - Integer (16-bit integer)

LI - Long Integer (32-bit integer)

SI - Short Integer (8-bit integer)

The *Notes* column uses the following abbreviations:

GRP – Group Template Member

FLT – Fault Template Member

RPT – Report Template Member

NS - Not Supported

TS - Time Stamp format: MSEC of the day (0 to 86,400,000 msec) and DAYs since 01/01/1984.

*Table 4. Register Table*

### REGISTER TABLE – ORDERED BY REGISTER NUMBER

Holding Register	Parameter	Read/Write Supported	Data Format	Notes
<u><i>Session Parameters</i></u>				
40001	Exit	R W	ASC(1)	
40002-05	Access Password	R W	ASC(8)	
40006	Access Request	R W	BM(16)	
<u><i>Template Parameters</i></u>				
40036	Settings Group Selection	R W	SI	
40037	Report Selection	R W	SI	
40038	Report Focus	R W	INT	
<u><i>Global Parameters</i></u>				
40080-83	Global Password	R W	ASC(8)	
40084	Global Path	R W	BM(8)	
40085-88	Setting Password	R W	ASC(8)	
40089	Setting Path	R W	BM(8)	
40090-93	Control Password	R W	ASC(8)	
40094	Control Path	R W	BM(8)	
40095-98	Report Password	R W	ASC(8)	

40099	Report Path	R W	BM(8)
<u>Control Parameters</u>			
40117	Select Group	R W	ASC(1)
40118	Operate Group	R W	ASC(1)
40119	Select Virtual Selector Switch 43	R W	ASC(1)
40120	Operate Virtual Selector Switch 43	R W	ASC(1)
40121	Select Virtual Selector Switch 143	R W	ASC(1)
40122	Operate Virtual Selector Switch 143	R W	ASC(1)
40123	Select Virtual Selector Switch 243	R W	ASC(1)
40124	Operate Virtual Selector Switch 243	R W	ASC(1)
40125	Select Virtual Selector Switch 343	R W	ASC(1)
40126	Operate Virtual Selector Switch 343	R W	ASC(1)
40127	Select Virtual Selector Switch 443	R W	ASC(1)
40128	Operate Virtual Selector Switch 443	R W	ASC(1)
40129	Select Virtual Selector Switch 543	R W	ASC(1)
40130	Operate Virtual Selector Switch 543	R W	ASC(1)
40131	Select Virtual Selector Switch 643	R W	ASC(1)
40132	Operate Virtual Selector Switch 643	R W	ASC(1)
40133	Select Virtual Selector Switch 743	R W	ASC(1)
40134	Operate Virtual Selector Switch 743	R W	ASC(1)
40137	Select All Outputs	R W	ASC(1)
40138	Operate All Outputs	R W	ASC(1)
40139	Select Output A	R W	ASC(1)
40140	Operate Output A	R W	ASC(1)
40141	Select Output 1	R W	ASC(1)
40142	Operate Output 1	R W	ASC(1)
40143	Select Output 2	R W	ASC(1)

40144	Operate Output 2	R W	ASC(1)
40145	Select Output 3	R W	ASC(1)
40146	Operate Output 3	R W	ASC(1)
40147	Select Output 4	R W	ASC(1)
40148	Operate Output 4	R W	ASC(1)
40149	Select Output 5	R W	ASC(1)
40150	Operate Output 5	R W	ASC(1)
40151	Select Output 6	R W	ASC(1)
40152	Operate Output 6	R W	ASC(1)

Group Setting Parameters

*The following is the Group Template (GRP)*

40269-70	62 Time Delay 1	R W	LI	GRP
40271-72	62 Time Delay 2	R W	LI	GRP
40273-74	162 Time Delay 1	R W	LI	GRP
40275-76	162 Time Delay 2	R W	LI	GRP
40277	PSS Control	R W	MINT	GRP
40278-79	ET Time Limiter Constant	R W	FP	GRP
40280-81	ET Limiter Set Point	R W	FP	GRP
40282-83	PSS Unit Inertia	R W	FP	GRP
40284-85	PSS Stabilizer Gain Constant	R W	FP	GRP
40286-87	PSS Stabilizer Upper Limit	R W	FP	GRP
40288-89	PSS Stabilizer Lower Limit	R W	FP	GRP
40290-91	Mechanical Power Low-Pass Filter Time Constant	R W	FP	GRP
40292-93	Logic Trigger #1 Value	R W	FP	GRP
40294	Logic Trigger #1 Direction	R W	SI	GRP
40295	Logic Trigger #1 Absolute	R W	SI	GRP
40296-97	Logic Trigger #2 Value	R W	FP	GRP
40298	Logic Trigger #2 Direction	R W	SI	GRP
40299	Logic Trigger #2 Absolute	R W	SI	GRP
40300-01	Logic Trigger #3 Value	R W	FP	GRP
40302	Logic Trigger #3 Direction	R W	SI	GRP
40303	Logic Trigger #3 Absolute	R W	SI	GRP
40304-05	Logic Trigger #4 Value	R W	FP	GRP
40306	Logic Trigger #4 Direction	R W	SI	GRP
40307	Logic Trigger #4 Absolute	R W	SI	GRP
40308-09	Logic Trigger #5 Value	R W	FP	GRP
40310	Logic Trigger #5 Direction	R W	SI	GRP
40311	Logic Trigger #5 Absolute	R W	SI	GRP
40312-13	Logic Trigger #6 Value	R W	FP	GRP
40314	Logic Trigger #6 Direction	R W	SI	GRP
40315	Logic Trigger #6 Absolute	R W	SI	GRP
40316-17	Logic Trigger #7 Value	R W	FP	GRP
40318	Logic Trigger #7 Direction	R W	SI	GRP
40319	Logic Trigger #7 Absolute	R W	SI	GRP
40320-21	Logic Trigger #8 Value	R WFP	GRP	
40322	Logic Trigger #8 Direction	R W	SI	GRP
40323	Logic Trigger #8 Absolute	R W	SI	GRP
40324-25	Logic Trigger #9 Value	R W	FP	GRP

40326	Logic Trigger #9 Direction	R W	SI	GRP
40327	Logic Trigger #9 Absolute	R W	SI	GRP
40328-29	Logic Trigger #10 Value	R W	FP	GRP
40330	Logic Trigger #10 Direction	R W	SI	GRP
40331	Logic Trigger #10 Absolute	R W	SI	GRP
40332-33	Logic Trigger #11 Value	R W	FP	GRP
40334	Logic Trigger #11 Direction	R W	SI	GRP
40335	Logic Trigger #11 Absolute	R W	SI	GRP
40336-37	Logic Trigger #12 Value	R W	FP	GRP
40338	Logic Trigger #12 Direction	R W	SI	GRP
40339	Logic Trigger #12 Absolute	R W	SI	GRP
40340-41	Logic Trigger #13 Value	R W	FP	GRP
40342	Logic Trigger #13 Direction	R W	SI	GRP
40343	Logic Trigger #13 Absolute	R W	SI	GRP
40344-45	Logic Trigger #14 Value	R W	FP	GRP
40346	Logic Trigger #14 Direction	R W	SI	GRP
40347	Logic Trigger #14 Absolute	R W	SI	GRP
40348-49	Logic Trigger #15 Value	R W	FP	GRP
40350	Logic Trigger #15 Direction	R W	SI	GRP
40351	Logic Trigger #15 Absolute	R W	SI	GRP
40352-53	Logic Trigger #16 Value	R W	FP	GRP
40354	Logic Trigger #16 Direction	R W	SI	GRP
40355	Logic Trigger #16 Absolute	R W	SI	GRP
40356-57	Logic Trigger #17 Value	R W	FP	GRP
40358	Logic Trigger #17 Direction	R W	SI	GRP
40359	Logic Trigger #17 Absolute	R W	SI	GRP
40360-61	Logic Trigger #18 Value	R W	FP	GRP
40362	Logic Trigger #18 Direction	R W	SI	GRP
40363	Logic Trigger #18 Absolute	R W	SI	GRP
40364-65	Logic Trigger #19 Value	R W	FP	GRP
40366	Logic Trigger #19 Direction	R W	SI	GRP
40367	Logic Trigger #19 Absolute	R W	SI	GRP
40368-69	Logic Trigger #20 Value	R W	FP	GRP
40370	Logic Trigger #20 Direction	R W	SI	GRP
40371	Logic Trigger #20 Absolute	R W	SI	GRP
40372-73	Power-On Threshold	R W	FP	GRP
40374-75	Power Hysteresis	R W	FP	GRP
40376-77	Quadrature Axis Compensation	R W	FP	GRP
40378-79	PSS Output Scale Constant	R W	FP	GRP
40380	PSS Software Switch 1	R W	SI	GRP
40381	PSS Software Switch 2	R W	SI	GRP
40382	PSS Software Switch 3	R W	SI	GRP
40383	PSS Software Switch 4	R W	SI	GRP
40384	PSS Software Switch 5	R W	SI	GRP
40385	PSS Software Switch 6	R W	SI	GRP
40386	PSS Software Switch 7	R W	SI	GRP
40387	PSS Software Switch 8	R W	SI	GRP

40388	PSS Software Switch 9	R W	SI	GRP
40389	PSS Software Switch 10	R W	SI	GRP
40396-97	1 <sup>st</sup> Phase Lead Time Constant 1	R W	FP	GRP
40398-99	1 <sup>st</sup> Phase Lag Time Constant 1	R W	FP	GRP
40400-01	2 <sup>nd</sup> Phase Lead Time Constant 1	R W	FP	GRP
40402-03	2 <sup>nd</sup> Phase Lag Time Constant 1	R W	FP	GRP
40404-05	3 <sup>rd</sup> Phase Lead Time Constant 1	R W	FP	GRP
40406-07	3 <sup>rd</sup> Phase Lag Time Constant 1	R W	FP	GRP
40408-09	4 <sup>th</sup> Phase Lead Time Constant 1	R W	FP	GRP
40410-11	4 <sup>th</sup> Phase Lag Time Constant 1	R W	FP	GRP
40412	Sweep Type	R W	INT	GRP
40413-14	Start Frequency	R W	FP	GRP
40415-16	Signal Sweep Frequency Step	R W	FP	GRP
40417-18	Signal End Frequency	R W	FP	GRP
40419	Signal Selection	R W	INT	GRP
40420-21	Signal Magnitude	R W	FP	GRP
40422-23	Signal Offset	R W	FP	GRP
40424-25	Signal Duration	R W	FP	GRP
40426-27	Signal Frequency	R W	FP	GRP
40428	Test Switch 1	R W	MINT	GRP
40429	Test Switch 2	R W	MINT	GRP
40430	Test Switch 3	R W	MINT	GRP
40431	Test Switch 4	R W	MINT	GRP
40438-39	1 <sup>st</sup> Wash Timeout Constant	R W	FP	GRP
40440-41	2 <sup>nd</sup> Wash Timeout Constant	R W	FP	GRP
40442-43	Torsional Filter 1 zeta num	R W	FP	GRP
40444-45	Torsional Filter 1 zeta den	R W	FP	GRP
40446-47	Torsional Filter 1 omega	R W	FP	GRP
40448-49	Torsional Filter 2 zeta num	R W	FP	GRP
40450-51	Torsional Filter 2 zeta den	R W	FP	GRP
40452-53	Torsional Filter 2 omega	R W	FP	GRP
40454-55	Washout Filter Normal Time	R W	FP	GRP
40456-57	Washout Filter Limit Time	R W	FP	GRP
40458-59	Logic Limit High Level	R W	FP	GRP
40460-61	Logic Limit Low Level	R W	FP	GRP
40462-63	Logic Limit Time Delay	R W	FP	GRP

Global Setting Parameters

40617	Test On Enable Switch	R W	FP	
	Read and Write: 0 for disabled, 1 for enabled			
40618	Input 1 Contact Recognition Time Delay	R W	SI	
40619	Input 1 Contact Debounce Time Delay	R W	SI	
40620	Input 2 Contact Recognition Time Delay	R W	SI	
40621	Input 2 Contact Debounce Time Delay	R W	SI	
40622	Input 3 Contact Recognition Time Delay	R W	SI	
40623	Input 3 Contact Debounce Time Delay	R W	SI	
40624	Input 4 Contact Recognition Time Delay	R W	SI	
40625	Input 4 Contact Debounce Time Delay	R W	SI	
40626	Input 5 Contact Recognition Time Delay	R W	SI	
40627	Input 5 Contact Debounce Time Delay	R W	SI	
40628	Input 6 Contact Recognition Time Delay	R W	SI	

40629	Input 6 Contact Debounce Time Delay	R W	SI
40630	Input 7 Contact Recognition Time Delay	R W	SI
40631	Input 7 Contact Debounce Time Delay	R W	SI
40632	Input 8 Contact Recognition Time Delay	R W	SI
40633	Input 8 Contact Debounce Time Delay	R W	SI
40746-870	Contiguous Poll Block Assignments	R W	INT
40871	Setting Group Control On Time	R W	INT
	<u>Setting Group 1</u>		
40872	Automatic Control Switch Time	R W	SI
40873	Automatic Control Switch Level	R W	SI
40874	Automatic Control Return Time	R W	SI
40875	Automatic Control Return Level	R W	SI
40876-77	Power Level	R W	FP
	<u>Setting Group 2</u>		
40878	Automatic Control Switch Time	R W	SI
40879	Automatic Control Switch Level	R W	SI
40880	Automatic Control Return Time	R W	SI
40881	Automatic Control Return Level	R W	SI
40882-83	2 Power Level	R W	FP
	<u>Setting Group 3</u>		
40884	Automatic Control Switch Time	R W	SI
40885	Automatic Control Switch Level	R W	SI
40886	Automatic Control Return Time	R W	SI
40887	Automatic Control Return Level	R W	SI
40888-89	Power Level	R W	FP

Serial Port Setting Parameters

40962	Serial Port 0 Baud Rate	R W	INT
40964	Serial Port 0 Software Flow Control	R W	SI
40965	Serial Port 0 Page Length	R W	SI
40966	Serial Port 0 Acknowledgement Format	R W	SI
40971	Serial Port 1 Baud Rate	R W	INT
40972	Serial Port 1 Relay Address	R W	INT
40973	Serial Port 1 Software Flow Control	R W	SI
40974	Serial Port 1 Page Length	R W	SI
40975	Serial Port 1 Acknowledgement Format	R W	SI
40980	Serial Port 2 Baud Rate	R W	INT
40981	Serial Port 2 Relay Address	R W	INT
40986	Serial Port 2 Modbus Parity	R W	SI
40987	Serial Port 2 Modbus Remote Delay	R W	SI
40988	Serial Port 2 Modbus Stop Bits	R W	SI

System Data Setting Parameters

41019	System Frequency	R W	SI
41020	Phase Rotation	R W	SI
41021	Phase CT Ratio	R W	INT
41022	Phase VT Ratio	R W	INT
41023	Phase VT Configuration	R W	SI
41025-26	kV Voltage Rating	R W	FP
41027-28	MVA Voltamp Rating	R W	FP

Relay Data Setting Parameters

41265-66	Major Alarm Mask	R W	BM(32)
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41267-68	Minor Alarm Mask	R W	BM(32)
41269-70	Logic Alarm Mask	R W	BM(32)
41272	Clock Format – Date	R W	ASC(1)
41273	Clock Format – Time	R W	SI
41274	Clock Format – Daylight Savings	R W	SI
41284	Output Hold Mask	R W	BM(8)
41286	Load Profile Interval	R W	SI
41287-92	Report Log Trigger Logic Mask	R W	BM(96)
41295-300	Report Log Trigger Logic Term	R W	BM(96)
41303-05	Record Log Points Logic Mask	R W	BM(48)
41306-11	Reset Alarm Logic Mask	R W	BM(96)
41314-19	Reset Alarm Logic Term	R W	BM(96)
41322	Tune Mode	R W	INT

Custom Logic Setting Parameters

41465-68	User Custom Logic Name	R W	ASC(8)
41469-72	Current Active Logic Scheme	R W	ASC(8)
41473-76	Custom Logic Name	R -	ASC(8)
41477-80	Standard Logic #1 Name	R -	ASC(8)
41481-84	Standard Logic #2 Name	R -	ASC(8)
41485-88	Standard Logic #3 Name	R -	ASC(8)
41489-92	Standard Logic #4 Name	R -	ASC(8)
41493-96	Standard Logic #5 Name	R -	ASC(8)
41497-500	Standard Logic #6 Name	R -	ASC(8)
41501-04	Standard Logic #7 Name	R -	ASC(8)
41508	62 Mode	R W	INT
41509-14	62 Start Logic Mask	R W	BM(96)
41517-22	62 Start Logic Term	R W	BM(96)
41525-30	62 Block Logic Mask	R W	BM(96)
41533-38	62 Block Logic Term	R W	BM(96)
41541	162 Mode	R W	INT
41542-47	162 Start Logic Mask	R W	BM(96)
41550-55	162 Start Logic Term	R W	BM(96)
41558-63	162 Block Logic Mask	R W	BM(96)
41566-71	162 Block Logic Term	R W	BM(96)
41574	PSS Output Mode	R W	INT
41575-80	PSS Output Control Logic Mask	R W	BM(96)
41583-88	PSS Output Control Logic Term	R W	BM(96)
41591-96	PSS Output Test Logic Mask	R W	BM(96)
41599-604	PSS Output Test Logic Term	R W	BM(96)
41607	PSS Motor/Ph. Seq. Mode	R W	INT
41608-13	PSS Motor Mode Control Logic Mask	R W	BM(96)
41616-21	PSS Motor Mode Control Logic Term	R W	BM(96)
41624-29	PSS Phase Seq. Logic Mask	R W	BM(96)
41632-637	PSS Phase Seq. Logic Term	R W	BM(96)

Programmable Settings

42010	Group Logic Mode	R W	INT
42011-16	Group Block Logic Mask	R W	BM(96)
42019-24	Group Block Logic Term	R W	BM(96)

42027-32	Group0 Select Logic Mask	R W	BM(96)
42035-40	Group0 Select Logic Term	R W	BM(96)
42043-48	Group1 Select Logic Mask	R W	BM(96)
42051-56	Group1 Select Logic Term	R W	BM(96)
42059-64	Group2 Select Logic Mask	R W	BM(96)
42067-72	Group2 Select Logic Term	R W	BM(96)
42075-80	Group3 Select Logic Mask	R W	BM(96)
42083-88	Group3 Select Logic Term	R W	BM(96)
	<u>Programmable Virtual Switches</u>		
42091	43 Virtual Switch Logic Mode	R W	INT
42092	143 Virtual Switch Logic Mode	R W	INT
42093	243 Virtual Switch Logic Mode	R W	INT
42094	343 Virtual Switch Logic Mode	R W	INT
42095	443 Virtual Switch Logic Mode	R W	INT
42096	543 Virtual Switch Logic Mode	R W	INT
42097	643 Virtual Switch Logic Mode	R W	INT
42098	743 Virtual Switch Logic Mode	R W	INT
	<u>Programmable Virtual Outputs</u>		
42133	Output A Term Count	R W	SI
42134-39	Output A Logic Mask 1	R W	BM(96)
42142-47	Output A Logic Term 1	R W	BM(96)
42150-55	Output A Logic Mask 2	R W	BM(96)
42158-63	Output A Logic Term 2	R W	BM(96)
42166-71	Output A Logic Mask 3	R W	BM(96)
42174-79	Output A Logic Term 3	R W	BM(96)
42182-87	Output A Logic Mask 4	R W	BM(96)
42190-95	Output A Logic Term 4	R W	BM(96)
42198	Output 1 Term Count	R W	SI
42199-204	Output 1 Logic Mask 1	R W	BM(96)
42207-12	Output 1 Logic Term 1	R W	BM(96)
42215-20	Output 1 Logic Mask 2	R W	BM(96)
42223-28	Output 1 Logic Term 2	R W	BM(96)
42231-36	Output 1 Logic Mask 3	R W	BM(96)
42239-44	Output 1 Logic Term 3	R W	BM(96)
42247-52	Output 1 Logic Mask 4	R W	BM(96)
42255-60	Output 1 Logic Term 4	R W	BM(96)
42263	Output 2 Term Count	R W	SI
42264-69	Output 2 Logic Mask 1	R W	BM(96)
42272-77	Output 2 Logic Term 1	R W	BM(96)
42280-85	Output 2 Logic Mask 2	R W	BM(96)
42288-93	Output 2 Logic Term 2	R W	BM(96)
42296-301	Output 2 Logic Mask 3	R W	BM(96)
42304-09	Output 2 Logic Term 3	R W	BM(96)
42312-17	Output 2 Logic Mask 4	R W	BM(96)
42320-25	Output 2 Logic Term 4	R W	BM(96)
	<u>Programmable Virtual Outputs—continued</u>		
42328	Output 3 Term Count	R W	SI
42329-34	Output 3 Logic Mask 1	R W	BM(96)
42337-42	Output 3 Logic Term 1	R W	BM(96)
42345-50	Output 3 Logic Mask 2	R W	BM(96)
42353-58	Output 3 Logic Term 2	R W	BM(96)
42361-66	Output 3 Logic Mask 3	R W	BM(96)
42369-74	Output 3 Logic Term 3	R W	BM(96)
42377-82	Output 3 Logic Mask 4	R W	BM(96)

42385-90	Output 3 Logic Term 4	R W	BM(96)
42393	Output 4 Term Count	R W	SI
42394-99	Output 4 Logic Mask 1	R W	BM(96)
42402-07	Output 4 Logic Term 1	R W	BM(96)
42410-15	Output 4 Logic Mask 2	R W	BM(96)
42418-23	Output 4 Logic Term 2	R W	BM(96)
42426-31	Output 4 Logic Mask 3	R W	BM(96)
42434-39	Output 4 Logic Term 3	R W	BM(96)
42442-47	Output 4 Logic Mask 4	R W	BM(96)
42450-55	Output 4 Logic Term 4	R W	BM(96)
42458	Output 5 Term Count	R W	SI
42459-64	Output 5 Logic Mask 1	R W	BM(96)
42467-72	Output 5 Logic Term 1	R W	BM(96)
42475-80	Output 5 Logic Mask 2	R W	BM(96)
42483-88	Output 5 Logic Term 2	R W	BM(96)
42491-96	Output 5 Logic Mask 3	R W	BM(96)
42499-504	Output 5 Logic Term 3	R W	BM(96)
42507-12	Output 5 Logic Mask 4	R W	BM(96)
42515-20	Output 5 Logic Term 4	R W	BM(96)
42523	Output 6 Term Count	R W	SI
42524-29	Output 6 Logic Mask 1	R W	BM(96)
42532-37	Output 6 Logic Term 1	R W	BM(96)
42540-45	Output 6 Logic Mask 2	R W	BM(96)
42548-53	Output 6 Logic Term 2	R W	BM(96)
42556-61	Output 6 Logic Mask 3	R W	BM(96)
42564-69	Output 6 Logic Term 3	R W	BM(96)
42572-77	Output 6 Logic Mask 4	R W	BM(96)
42580-85	Output 6 Logic Term 4	R W	BM(96)
42588	Output 7 Term Count	R W	SI
42589-94	Output 7 Logic Mask 1	R W	BM(96)
42597-602	Output 7 Logic Term 1	R W	BM(96)
42605-10	Output 7 Logic Mask 2	R W	BM(96)
42613-18	Output 7 Logic Term 2	R W	BM(96)
42621-26	Output 7 Logic Mask 3	R W	BM(96)
42629-34	Output 7 Logic Term 3	R W	BM(96)
42637-42	Output 7 Logic Mask 4	R W	BM(96)
42645-50	Output 7 Logic Term 4	R W	BM(96)
42653	Output 8 Term Count	R W	SI
42654-59	Output 8 Logic Mask 1	R W	BM(96)
42662-67	Output 8 Logic Term 1	R W	BM(96)
42670-75	Output 8 Logic Mask 2	R W	BM(96)
42678-83	Output 8 Logic Term 2	R W	BM(96)
42686-91	Output 8 Logic Mask 3	R W	BM(96)
42694-99	Output 8 Logic Term 3	R W	BM(96)
42702-07	Output 8 Logic Mask 4	R W	BM(96)
42710-15	Output 8 Logic Term 4	R W	BM(96)
	<u>Programmable Virtual Outputs—continued</u>		
42718	Output 9 Term Count	R W	SI
42719-24	Output 9 Logic Mask 1	R W	BM(96)
42727-32	Output 9 Logic Term 1	R W	BM(96)
42735-40	Output 9 Logic Mask 2	R W	BM(96)
42743-48	Output 9 Logic Term 2	R W	BM(96)
42751-56	Output 9 Logic Mask 3	R W	BM(96)
42759-64	Output 9 Logic Term 3	R W	BM(96)
42767-72	Output 9 Logic Mask 4	R W	BM(96)
42775-80	Output 9 Logic Term 4	R W	BM(96)

42783	Output 10 Term Count	R W	SI
42784-89	Output 10 Logic Mask 1	R W	BM(96)
42792-97	Output 10 Logic Term 1	R W	BM(96)
42800-05	Output 10 Logic Mask 2	R W	BM(96)
42808-13	Output 10 Logic Term 2	R W	BM(96)
42816-21	Output 10 Logic Mask 3	R W	BM(96)
42824-29	Output 10 Logic Term 3	R W	BM(96)
42832-37	Output 10 Logic Mask 4	R W	BM(96)
42840-45	Output 10 Logic Term 4	R W	BM(96)
42848	Output 11 Term Count	R W	SI
42849-54	Output 11 Logic Mask 1	R W	BM(96)
42857-62	Output 11 Logic Term 1	R W	BM(96)
42865-70	Output 11 Logic Mask 2	R W	BM(96)
42873-78	Output 11 Logic Term 2	R W	BM(96)
42881-86	Output 11 Logic Mask 3	R W	BM(96)
42889-94	Output 11 Logic Term 3	R W	BM(96)
42897-902	Output 11 Logic Mask 4	R W	BM(96)
42905-10	Output 11 Logic Term 4	R W	BM(96)
42913	Output 12 Term Count	R W	SI
42914-19	Output 12 Logic Mask 1	R W	BM(96)
42922-27	Output 12 Logic Term 1	R W	BM(96)
42930-35	Output 12 Logic Mask 2	R W	BM(96)
42938-43	Output 12 Logic Term 2	R W	BM(96)
42946-51	Output 12 Logic Mask 3	R W	BM(96)
42954-59	Output 12 Logic Term 3	R W	BM(96)
42962-67	Output 12 Logic Mask 4	R W	BM(96)
42970-75	Output 12 Logic Term 4	R W	BM(96)
42978	Output 13 Term Count	R W	SI
42979-84	Output 13 Logic Mask 1	R W	BM(96)
42987-92	Output 13 Logic Term 1	R W	BM(96)
42995-3000	Output 13 Logic Mask 2	R W	BM(96)
43003-08	Output 13 Logic Term 2	R W	BM(96)
43011-16	Output 13 Logic Mask 3	R W	BM(96)
43019-24	Output 13 Logic Term 3	R W	BM(96)
43027-32	Output 13 Logic Mask 4	R W	BM(96)
43035-40	Output 13 Logic Term 4	R W	BM(96)
43043	Output 14 Term Count	R W	SI
43044-49	Output 14 Logic Mask 1	R W	BM(96)
43052-57	Output 14 Logic Term 1	R W	BM(96)
43060-65	Output 14 Logic Mask 2	R W	BM(96)
43068-73	Output 14 Logic Term 2	R W	BM(96)
43076-81	Output 14 Logic Mask 3	R W	BM(96)
43084-89	Output 14 Logic Term 3	R W	BM(96)
43092-97	Output 14 Logic Mask 4	R W	BM(96)
43100-05	Output 14 Logic Term 4	R W	BM(96)
<u>Programmable Virtual Outputs—continued</u>			
43108	Output 15 Term Count	R W	SI
43109-14	Output 15 Logic Mask 1	R W	BM(96)
43117-22	Output 15 Logic Term 1	W	BM(96)
43125-30	Output 15 Logic Mask 2	R W	BM(96)
43133-38	Output 15 Logic Term 2	R W	BM(96)
43141-46	Output 15 Logic Mask 3	R W	BM(96)
43149-54	Output 15 Logic Term 3	R W	BM(96)
43157-62	Output 15 Logic Mask 4	R W	BM(96)
43165-70	Output 15 Logic Term 4	R W	BM(96)

### System Labels And ID Setting Parameters

43438-52	User ID #1	R W	ASC(30)
43453-67	User ID #2	R W	ASC(30)
43468-82	User ID #3	R W	ASC(30)
43483-97	User ID #4	R W	ASC(30)
<u>Virtual Selector Switches</u>			
43498-505	Switch 43 – Name Label	R W	ASC(16)
43506-09	Switch 43 – True Label	R W	ASC(7)
43510-13	Switch 43 – False Label	R W	ASC(7)
43514-21	Switch 143 – Name Label	R W	ASC(16)
43522-25	Switch 143 – True Label	R W	ASC(7)
43526-29	Switch 143 – False Label	R W	ASC(7)
43530-37	Switch 243 – Name Label	R W	ASC(16)
43538-41	Switch 243 – True Label	R W	ASC(7)
43542-45	Switch 243 – False Label	R W	ASC(7)
43546-53	Switch 343 – Name Label	R W	ASC(16)
43554-57	Switch 343 – True Label	R W	ASC(7)
43558-61	Switch 343 – False Label	R W	ASC(7)
43562-69	Switch 443 – Name Label	R W	ASC(16)
43570-73	Switch 443 – True Label	R W	ASC(7)
43574-77	Switch 443 – False Label	R W	ASC(7)
43578-85	Switch 543 – Name Label	R W	ASC(16)
43586-89	Switch 543 – True Label	R W	ASC(7)
43590-93	Switch 543 – False Label	R W	ASC(7)
43594-601	Switch 643 – Name Label	R W	ASC(16)
43602-05	Switch 643 – True Label	R W	ASC(7)
43606-09	Switch 643 – False Label	R W	ASC(7)
43610-17	Switch 743 – Name Label	R W	ASC(16)
43618-21	Switch 743 – True Label	R W	ASC(7)
43622-25	Switch 743 – False Label	R W	ASC(7)
<u>Virtual Outputs</u>			
43626-33	Output A – Name Label	R W	ASC(16)
43634-37	Output A – True Label	R W	ASC(7)
43638-41	Output A – False Label	R W	ASC(7)
43642-49	Output 1 – Name Label	R W	ASC(16)
43650-53	Output 1 - True Label	R W	ASC(7)
43654-57	Output 1 – False Label	R W	ASC(7)
43658-65	Output 2 – Name Label	R W	ASC(16)
43666-69	Output 2 – True Label	R W	ASC(7)
43670-73	Output 2 – False Label	R W	ASC(7)
43674-81	Output 3 – Name Label	R W	ASC(16)
43682-85	Output 3 – True Label	R W	ASC(7)
43686-89	Output 3 – False Label	R W	ASC(7)
43690-97	Output 4 – Name Label	R W	ASC(16)
43698-701	Output 4 – True Label	R W	ASC(7)
43702-05	Output 4 – False Label	R W	ASC(7)
43706-13	Output 5 – Name Label	R W	ASC(16)
43714-17	Output 5 – True Label	R W	ASC(7)
43718-21	Output 5 – False Label	R W	ASC(7)

43722-29	Output 6 – Name Label	R W	ASC(16)
43730-33	Output 6 – True Label	R W	ASC(7)
43734-37	Output 6 – False Label	R W	ASC(7)
43738-45	Output 7 – Name Label	R W	ASC(16)
43746-49	Output 7 – True Label	R W	ASC(7)
43750-53	Output 7 – False Label	R W	ASC(7)
43754-61	Output 8 – Name Label	R W	ASC(16)
43762-65	Output 8 – True Label	R W	ASC(7)
43766-69	Output 8 – False Label	R W	ASC(7)
43770-77	Output 9 – Name Label	R W	ASC(16)
43778-81	Output 9 – True Label	R W	ASC(7)
43782-85	Output 9 – False Label	R W	ASC(7)
43786-91	Output 10 – Name Label	R W	ASC(16)
43794-97	Output 10 – True Label	R W	ASC(7)
43798-801	Output 10 – False Label	R W	ASC(7)
43802-09	Output 11 – Name Label	R W	ASC(16)
43810-13	Output 11 – True Label	R W	ASC(7)
43814-17	Output 11 – False Label	R W	ASC(7)
43818-25	Output 12 – Name Label	R W	ASC(16)
43826-29	Output 12 – True Label	R W	ASC(7)
43830-33	Output 12 – False Label	R W	ASC(7)
43834-41	Output 13 – Name Label	R W	ASC(16)
43842-45	Output 13 – True Label	R W	ASC(7)
43846-49	Output 13 – False Label	R W	ASC(7)
43850-57	Output 14 – Name Label	R W	ASC(16)
43858-61	Output 14 – True Label	R W	ASC(7)
43862-65	Output 14 – False Label	R W	ASC(7)
43866-73	Output 15 – Name Label	R W	ASC(16)
43874-77	Output 15 – True Label	R W	ASC(7)
43878-81	Output 15 – False Label	R W	ASC(7)
43882-89	Input 1 – Name Label	R W	ASC(16)
43890-93	Input 1 – True Label	R W	ASC(7)
43894-97	Input 1 – False Label	R W	ASC(7)
43898-905	Input 2 – Name Label	R W	ASC(16)
43906-09	Input 2 – True Label	R W	ASC(7)
43910-13	Input 2 – False Label	R W	ASC(7)
43914-21	Input 3 – Name Label	R W	ASC(16)
43922-25	Input 3 – True Label	R W	ASC(7)
43926-29	Input 3 – False Label	R W	ASC(7)
43930-37	Input 4 – Name Label	R W	ASC(16)
43938-41	Input 4 – True Label	R W	ASC(7)
43942-45	Input 4 – False Label	R W	ASC(7)
43946-53	Input 5 – Name Label	R W	ASC(16)
43954-57	Input 5 – True Label	R W	ASC(7)
43958-61	Input 5 – False Label	R W	ASC(7)
43962-69	Input 6 – Name Label	R W	ASC(16)
43970-73	Input 6 – True Label	R W	ASC(7)

43974-77	Input 6 – False Label	R W	ASC(7)	
43978-85	Input 7 – Name Label	R W	ASC(16)	
43986-89	Input 7 – True Label	R W	ASC(7)	
43990-93	Input 7 – False Label	R W	ASC(7)	
43994-4001	Input 8 – Name Label	R W	ASC(16)	
44002-05	Input 8 – True Label	R W	ASC(7)	
44006-09	Input 8 – False Label	R W	ASC(7)	

Report Parameters

47274-78	Model Number	R -	ASC(10)	
47282-89	Application SW Version # / Date	R -	ASC(16)	
47296-303	Boot SW Version # / Date	R -	ASC(14)	
47310-16	Serial Number	R -	ASC(13)	
47324-34	Style Number	R -	ASC(21)	
47346-53	DSP SW Version # / Date	R -	ASC(16)	
47362	COM1 Serial Port Relay Address	R W	INT	
47363	COM2 Serial Port Relay Address	R W	INT	
47364	Date and Time – Day	R W	INT	TS
47365-66	Date and Time – Milliseconds	R W	LI	TS
47367-72	System Status	R -	BM(96)	
47373	Current Active Group Setting	R -	SI	
47374	Current Group Control Setting	R -	ASC(1)	
47375-76	Current Output Pulse	R -	BM(32)	
47377-78	Current Output Latch	R -	BM(32)	
47379	Current Output Contact Status	R -	BM(16)	
47380-81	Active Alarm Flags (SumFlags)	R -	BM(32)	
47382-83	Active Alarm Flags (ProgAlarms)	R -	BM(32)	
47389-92	Current Active Logic	R -	ASC(8)	
47486	Reset Logic Alarm Information	R W	SI	
47487	Reset Major Alarm Information	R W	SI	
47488	Reset Minor Alarm Information	R W	SI	
47489	Reset Relay Alarm Information	R W	SI	
47493	Clear Events Report	R W	SI	

*The following is the Report Template (RPT)*

47595-719	Report Text	R -	ASC(250)	RPT
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Metering Parameters

49720	Part Number	R -	INT	
49726-27	Phase A Current Magnitude	R -	FP	
49728-29	Phase A Angle	R -	FP	
49730-31	Phase B Current Magnitude	R -	FP	
49732-33	Phase B Angle	R -	FP	
49734-35	Phase C Current Magnitude	R -	FP	
49736-37	Phase C Angle	R -	FP	

49738-39	Positive Sequence Current Magnitude	R -	FP
49740-41	Negative Sequence Current Magnitude	R -	FP
49789-90	Generator Voltage	R -	FP
49791-92	Generator Current	R -	FP
49793-94	Generator Frequency	R -	FP
49795-96	Generator Compensated Frequency	R -	FP
49797-98	Watts	R -	FP
49799-800	Vars	R -	FP
49801-02	Power Factor	R -	FP
49803-04	Phase A Voltage Magnitude	R -	FP
49805-06	Phase A Angle	R -	FP
49807-08	Phase B Voltage Magnitude	R -	FP
49809-10	Phase B Angle	R -	FP
49811-12	Phase C Voltage Magnitude	R -	FP
49813-14	Phase C Angle	R -	FP
49815-16	Positive Sequence Voltage	R -	FP
49817-18	Negative Sequence Voltage	R -	FP
49835-54	Error Details	R -	ASC(40)
49875-999	Contiguous Poll Block	R -	Mixed

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## REGISTER DETAILS

This section details the register formats and data ranges of the previous section. The two sections combined provide all information necessary to communicate with the PSS-100 Modbus holding registers.

Any holding register not listed in the Register Table is an unassigned Holding Register. A value of zero always results when reading an unassigned Holding Register. Writes to unassigned Holding Registers are legal, but no action will be taken (the write is ignored).

### Logic Settings

Logic settings consist of a combination of modes, masks, terms and term counts. Logic modes are specific to each logic set, while the masks, terms and term counts have value definitions consistent throughout all logic sets. A single logic equation consists of a "mask" and "term" pair. The logic "term count" is used only in VOA, VO1-VO15 virtual output logic blocks.

The logic "mode" enables or disables the logic equation for that logic block.

The logic "mask" corresponds to the SystemStatus bits to be evaluated. These bits are referenced in the desired logic equation and are set to 1 (non-used bits masked out as 0's).

The logic "term" corresponds to the SystemStatus bit's TRUE or FALSE state, referenced in the desired logic equation where only the TRUE bits in the equation are set to 1.

The logic "term count" may be of one of four logic types which are NONE (logic disabled), OR only (  $a + b + c$  ), AND only (  $a*b*c$  ) or MIXED (  $a*b + b*c$  ).

The following defines all logic set parameters.

Logic Modes

41508	Programmable 62 Logic Mode	INT
41541	Programmable 162 Logic Mode	INT
	Read and Write:	
	0 for disabled	
	1 for Pickup / Dropout	
	2 for One-Shot Non-Retriggerable	
	3 for One-Shot Retriggerable	
	4 for Oscillator	
	5 for Integrating	
41574	Programmable PSS Output Logic Mode	INT
	Read and Write:	
	0 for disabled	
	1 for enabled	
42010	Programmable Settings Group Logic Mode	INT
	Read and Write:	
	0 for all setting groups disabled except group 0	
	1 for selecting setting group via pulsed input logic	
	2 for selecting setting group via sustained input logic	
42091	Programmable 43 Virtual Switch Logic Mode	INT
42092	Programmable 143 Virtual Switch Logic Mode	INT
42093	Programmable 243 Virtual Switch Logic Mode	INT
42094	Programmable 343 Virtual Switch Logic Mode	INT
42095	Programmable 443 Virtual Switch Logic Mode	INT
42096	Programmable 543 Virtual Switch Logic Mode	INT
42097	Programmable 643 Virtual Switch Logic Mode	INT
42098	Programmable 743 Virtual Switch Logic Mode	INT
	Read and Write:	
	0 for disabled	
	1 for on / off / pulse (all)	
	2 for on / off	
	3 for pulse	

Logic Mask And Terms

Each set bit in the "mask" parameter indicates a significant variable in the equation. A corresponding bit in the "term" parameter indicates that the variable must be TRUE / 1 if set or FALSE / 0 if not set.

Mask and Term – First Register (Logic Var 0 to 15) BM(16)

Read and Write:

- Bit 15 – Log Trigger Variable 16
- Bit 14 - Log Trigger Variable 15
- Bit 13 - Log Trigger Variable 14
- Bit 12 - Log Trigger Variable 13
- Bit 11 - Log Trigger Variable 12
- Bit 10 - Log Trigger Variable 11
- Bit 9 - Log Trigger Variable 10
- Bit 8 - Log Trigger Variable 9
- Bit 7 - Log Trigger Variable 8
- Bit 6 - Log Trigger Variable 7
- Bit 5 - Log Trigger Variable 6
- Bit 4 - Log Trigger Variable 5
- Bit 3 - Log Trigger Variable 4
- Bit 2 - Log Trigger Variable 3
- Bit 1 - Log Trigger Variable 2
- Bit 0 - Log Trigger Variable 1

Mask and Term – Second Register (Logic Var 16 to 31) BM(16)

Read and Write:

- Bit 15 – Logic 0
- Bit 14 – Setting Group 3
- Bit 13 - Setting Group 2
- Bit 12 - Setting Group 1
- Bit 11 - Setting Group 0
- Bit 10 – 162 Programmable Timer
- Bit 9 - 62 Programmable Timer
- Bit 8 - PSSON
- Bit 7 - Spare
- Bit 6 - Spare
- Bit 5 - Spare
- Bit 4 - Spare
- Bit 3 - Log Trigger Variable 20
- Bit 2 - Log Trigger Variable 19
- Bit 1 - Log Trigger Variable 18
- Bit 0 - Log Trigger Variable 17

Mask and Term – Third Register (Logic Var 32 to 47) BM(16)

Read and Write:

- Bit 15 – Virtual Output 15
- Bit 14 - Virtual Output 14
- Bit 13 - Virtual Output 13
- Bit 12 - Virtual Output 12
- Bit 11 - Virtual Output 11
- Bit 10 - Virtual Output 10
- Bit 9 - Virtual Output 9
- Bit 8 - Virtual Output 8
- Bit 7 - Virtual Output 7
- Bit 6 - Virtual Output 6
- Bit 5 - Virtual Output 5
- Bit 4 - Virtual Output 4
- Bit 3 - Virtual Output 3
- Bit 2 - Virtual Output 2
- Bit 1 - Virtual Output 1
- Bit 0 - Virtual Output A

Mask and Term – Fourth Register (Logic Var 48 to 63) BM(16)

Read and Write:

- Bit 15 - TSTCNTL
- Bit 14 - Spare3
- Bit 13 - Spare2
- Bit 12 - Spare1
- Bit 11 - ALMLGC
- Bit 10 - ALMMIN
- Bit 9 - ALMMAJ
- Bit 8 – PSS Control
- Bit 7 - Input 8
- Bit 6 - Input 7
- Bit 5 - Input 6
- Bit 4 - Input 5
- Bit 3 - Input 4
- Bit 2 - Input 3
- Bit 1 - Input 2
- Bit 0 – Input 1

Mask and Term – Fifth Register (Logic Var 64 to 79) BM(16)

Read and Write:

- Bit 15 - Spare19
- Bit 14 - Spare18
- Bit 13 - Spare17
- Bit 12 - Spare16
- Bit 11 - Spare15

Bit 10 - Spare14  
 Bit 9 - Spare13  
 Bit 8 - Spare12  
 Bit 7 - Spare11  
 Bit 6 - Spare10  
 Bit 5 - Spare9  
 Bit 4 - Spare8  
 Bit 3 - Spare7  
 Bit 2 - Spare6  
 Bit 1 - Spare5  
 Bit 0 - Spare4

Mask and Term – Sixth Register (Logic Var 80 to 95) BM(16)

Read and Write:

Bit 15 - 743  
 Bit 14 - 643  
 Bit 13 - 543  
 Bit 12 - 443  
 Bit 11 - 343  
 Bit 10 - 243  
 Bit 9 - 143  
 Bit 8 - 43  
 Bit 7 - Spare26  
 Bit 6 - Spare25  
 Bit 5 - TSTON  
 Bit 4 - Spare24  
 Bit 3 - Spare23  
 Bit 2 - Spare22  
 Bit 1 - Spare21  
 Bit 0 - Spare20

Logic Term Count

Term Count Register SI

Read and Write:

- 0 means the logic equation is disabled (NONE)
- 1 means the logic equation consists of a single term of ORed variables
- 1 means the logic equation consists of a single term of ANDED variables
- 2 means the logic equation consists of the ORing of 2 terms of ANDED variables
- 3 means the logic equation consists of the ORing of 3 terms of ANDED variables
- 4 means the logic equation consists of the ORing of 4 terms of ANDED variables

Session Parameters

40001 Exit ASC(1)

Read: always the ASCII character '0' (zero)

Write: ASCII characters 'Y' or 'N' ('Y' to save changes, 'N' to ignore changes)

Note: ERROR DETAIL block (49835-54) contains Exit status message following a write.

40002-5 Access Password ASC(8)

Read: always the ASCII string of '\*' characters.

Write: access password in ASCII string.

Note: If the password written is less than 8 characters long, a binary zero value must be included following the final password character.

40006 Access Request BM(16)

Read: returns the current write access available to the Modbus user

Bit 3 is set for Global Access

Bit 2 is set for Setting Access

Bit 1 is set for Control Access

Bit 0 is set for Report Access

Zero value for Read Only Access

Write: To request write privileges using the password written into Access Password registers. Value written into Access Request register is arbitrary (any value will initiate the request).

Note: If write access is denied, the response message will be an error response message with Illegal Function exception code.

Template Parameters

- 40036            Settings Group Selection            SI  
 Read: returns the current value of Settings Group Selection.  
 Write: the desired value to assign a Settings Group to the Group (GRP) Template.  
 0 for Settings Group 0  
 1 for Settings Group 1  
 2 for Settings Group 2  
 3 for Settings Group 3
- 40037            Report Selection                            SI  
 Read: returns the current value of Report Selection.  
 Writing to Report Selection terminates previous report and initializes new report. See table for values.
- 40038            Report Focus                                INT  
 Read: returns the current value of Report Focus.  
 Write: see table for values.  
 Note: If an illegal Report Focus value is written, the user is not notified until a read of the Report Text is attempted.

Note: Write to Report Selection and Report Focus to specify the report which will be made available via the Report (RPT) Template. The template is the Report Text Block at 47595-719.

*Table 5. Reports*

<b>Report Text 47595-719</b>	<b>Report Selection 40037</b>	<b>Report Focus 40038</b>
RA-LGC	0	Not used
RA-MAJ	1	Not used
RA-FAIL	2	Not used
RR	3	Not used
RR-#	4	Value of #
RR-NEW	5	Not used
RS	6	Not Used
RS-#	7	Value of #
RS-NEW	8	Not Used
	9	Not used
RS-ALM or RA-SER	10	Not used
RS-IO	11	Not Used
RS-LGC	12	Not used
RS-NEW Report		Not used

Global Parameters

- 40080-83        Global Password                            ASC(8)  
 40085-88        Setting Password                        ASC(8)  
 40090-93        Control Password                        ASC(8)  
 40095-98        Report Password                         ASC(8)  
 Read: If global access granted, password ASCII strings are read. Otherwise, The ASCII string of '\*' characters is read.  
 Write: Password in ASCII string.  
 Note: If password written is less than 8 characters long, a binary zero value must be included following the final password character.
- 40084            Global Path                                BM(8)  
 40089            Setting Path                              BM(8)

40094 Control Path BM(8)  
40099 Report Path BM(8)

Read: path associated with password.  
Write: path associated with password.

Bit 2 is set for COM 2 access.

Bit 1 is set for COM1 access.

Bit 0 is set for COM0 / FP access.

### Control Parameters

All values read from and written to Select and Operate registers are ASCII characters. Select registers must be written first, followed by a write to the Operate register. A 30-second window starts after the first write to the Select register. If the second write to the Operate register is not received within the 30-second window, an error response will be returned.

Writes to Operate registers 40138, 40140 – 40150 with ASCII data 'E' (Enable Output override control) or 'D' (Disable Output override control) requires an additional write of 'Y' to Exit register 40001 to allow these control settings to be saved to the relay's internal EEPROM.

NOTE: All values read from and written to Select and Operate registers are ASCII characters.

40117 Select Group ASC(1)

Read: To read a value other than ASCII character 'X', the Select Group register must be the most recent

control register written AND must have been written within the previous 30 seconds.

0 if Group 0 selection has been made.

1 if Group 1 selection has been made.

2 if Group 2 selection has been made.

3 if Group 3 selection has been made.

L if Logic selection has been made.

X if Group control not selected or control timer has expired

Write: the desired ASCII character.

0 to select Group 0.

1 to select Group 1.

2 to select Group 2.

3 to select Group 3.

L to select Logic.

40118 Operate Group ASC(1)

Read: Current control.

0 if Group 0.

1 if Group 1.

2 if Group 2.

3 if Group 3.

L if Logic.

Write: the desired ASCII character to alter control (corresponding Select register must contain same value, written within previous 30 seconds).

0 to select Group 0.

1 to select Group 1.

2 to select Group 2.

3 to select Group 3.

L to select Logic.

40119 Select Virtual Selector Switch 43 ASC(1)

40121 Select Virtual Selector Switch 143 ASC(1)

40123 Select Virtual Selector Switch 243 ASC(1)

40125 Select Virtual Selector Switch 343 ASC(1)

40127 Select Virtual Selector Switch 443 ASC(1)

40129 Select Virtual Selector Switch 543 ASC(1)

40131 Select Virtual Selector Switch 643 ASC(1)

40133 Select Virtual Selector Switch 743 ASC(1)

Read: To read a value other than ASCII character 'X', the Select Virtual Selector Switch register must be the most recent control register written AND must have been written within the previous 30 seconds.

P if Pulse Switch selection has been made.  
 0 if Latch Switch at 0 selection has been made.  
 1 if Latch Switch at 1 selection has been made.  
 X if Virtual Selector Switch control not selected or control timer has expired  
 Write: the desired ASCII character.  
 P to select Pulsing the Switch.  
 0 to select Latching the Switch at 0.  
 1 to select Latching the Switch at 1.

40120	Operate Virtual Selector Switch 43	ASC(1)
40122	Operate Virtual Selector Switch 143	ASC(1)
40124	Operate Virtual Selector Switch 243	ASC(1)
40126	Operate Virtual Selector Switch 343	ASC(1)
40128	Operate Virtual Selector Switch 443	ASC(1)
40130	Operate Virtual Selector Switch 543	ASC(1)
40132	Operate Virtual Selector Switch 643	ASC(1)
40134	Operate Virtual Selector Switch 743	ASC(1)

Read: Current control.  
 P if Pulse Switch.  
 0 if Latch Switch at 0.  
 1 if Latch Switch at 1.  
 Write: the desired ASCII character to alter control (corresponding Select register must contain same value, written within previous 30 seconds).  
 P to Pulse Switch.  
 0 to Latch Switch at 0.  
 1 to Latch Switch at 1.

40137	Select All Outputs	ASC(1)
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Read: To read a value other than ASCII character 'X', the Select All Output register must be the most recent control register written AND must have been written within the previous 30 seconds.

P if Pulse All Outputs selection has been made.  
 0 if Latch All Outputs at 0 selection has been made.  
 1 if Latch All Outputs at 1 selection has been made.  
 L if programmable Logic selection has been made.  
 E if Enable All Outputs override control has been set.  
 D if Disable All Outputs override control has been set.  
 X if All Outputs control not selected or control timer has expired  
 Write: the desired ASCII character.  
 P to select Pulsing All Outputs.  
 0 to select Latching All Outputs at 0.  
 1 to select Latching All Outputs at 1.  
 L to select programmable Logic.  
 E to select Enabling All Outputs override control.  
 D to select Disabling All Outputs override control.

40138	Operate All Outputs	ASC(1)
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Read: Current control.  
 E if All Outputs override control Enabled.  
 D if All Outputs override control Disabled.  
 Write: the desired ASCII character to alter control (corresponding Select register must contain same value, written within previous 30 seconds).  
 P to Pulse All Outputs.  
 0 to Latch All Outputs at 0.  
 1 to Latch All Outputs at 1.  
 L to select programmable Logic.  
 E to Enable All Outputs override control. \*  
 D to Disable All Outputs override control. \*

40139	Select Output A	ASC(1)
40141	Select Output 1	ASC(1)
40143	Select Output 2	ASC(1)
40145	Select Output 3	ASC(1)
40147	Select Output 4	ASC(1)

40149            Select Output 5            ASC(1)  
 40151            Select Output 6            ASC(1)

Read: To read a value other than ASCII character 'X', the Select Output register must be the most recent control register written AND must have been written within the previous 30 seconds.

P if Pulse Output selection has been made.  
 0 if Latch Output at 0 selection has been made.  
 1 if Latch Output at 1 selection has been made.  
 L if programmable Logic selection has been made.  
 E if Enable All Outputs serial control has been made.  
 D if Disable All Outputs serial control has been made.  
 X if Output control not selected or control timer has expired  
 Write: the desired ASCII character.  
 P to select Pulsing Output.  
 0 to select Latching Output at 0.  
 1 to select Latching Output at 1.  
 L to select programmable Logic.  
 E to select Enabling All Outputs override control.  
 D to select Disabling All Outputs override control.

40140            Operate Output A            ASC(1)  
 40142            Operate Output 1            ASC(1)  
 40144            Operate Output 2            ASC(1)  
 40146            Operate Output 3            ASC(1)  
 40148            Operate Output 4            ASC(1)  
 40150            Operate Output 5            ASC(1)  
 40152            Operate Output 6            ASC(1)

Read: Current control.  
 P to Pulse Output.  
 0 to Latch Output at 0.  
 1 to Latch Output at 1.  
 L to select programmable Logic.  
 D if All Outputs override control Disabled  
 Write: the desired ASCII character to alter control (corresponding Select register must contain same value, written within previous 30 seconds).  
 P to Pulse Output.  
 0 to Latch Output at 0.  
 1 to Latch Output at 1.  
 L to select programmable Logic.  
 E to Enable All Outputs override control. \*  
 D to Disable All Outputs override control. \*

\* requires an additional write of 'Y' to Exit register 40001 to allow these control settings to be saved to the relay's internal EEPROM.

Group Setting Parameters

40269-70        62 Time Delay 1            LI  
 40271-72        62 Time Delay 2            LI  
 40273-74        162 Time Delay 1            LI  
 40275-76        162 Time Delay 2            LI  
                   Read and Write: 0 to 3,600,000 milliseconds

40277            PSS Control                LI  
                   Read and Write: 1 to enable  
                                   0 to disable

40278-79        ET Time Limiter Constant  
                   Read and Write: 0.9 to 1.25

40280-81        ET Limiter Set Point  
                   Read and Write: 0.02 to 5

40282-83	PSS Unit Inertia Read and Write: 0.01 to 25	FP
40284-85	PSS Stabilizer Gain Constant Read and Write: 0 to 50	FP
40286-87	PSS Stabilizer Upper Limit Read and Write: 0.0 to 0.5	FP
40288-89	PSS Stabilizer Lower Limit Read and Write: -0.25 to 0.0	FP
40290-91	Mechanical Power Low Pass Filter Time Constant Read and Write: 0.05 to 0.20	FP
40292-93	Logic Trigger #1 Value	FP
40296-97	Logic Trigger #2 Value	FP
40300-01	Logic Trigger #3 Value	FP
40304-05	Logic Trigger #4 Value	FP
40308-09	Logic Trigger #5 Value	FP
40312-13	Logic Trigger #6 Value	FP
40316-17	Logic Trigger #7 Value	FP
40320-21	Logic Trigger #8 Value	FP
40324-25	Logic Trigger #9 Value	FP
40328-29	Logic Trigger #10 Value	FP
40332-33	Logic Trigger #11 Value	FP
40336-37	Logic Trigger #12 Value	FP
40340-41	Logic Trigger #13 Value	FP
40344-45	Logic Trigger #14 Value	FP
40348-49	Logic Trigger #15 Value	FP
40352-53	Logic Trigger #16 Value	FP
40356-57	Logic Trigger #17 Value	FP
40360-61	Logic Trigger #18 Value	FP
40364-65	Logic Trigger #19 Value	FP
40368-69	Logic Trigger #20 Value Read and Write: 0.00000 to 1.00000	FP
40294	Logic Trigger #1 Direction	SI
40298	Logic Trigger #2 Direction	SI
40302	Logic Trigger #3 Direction	SI
40306	Logic Trigger #4 Direction	SI
40310	Logic Trigger #5 Direction	SI
40314	Logic Trigger #6 Direction	SI
40318	Logic Trigger #7 Direction	SI
40322	Logic Trigger #8 Direction	SI
40326	Logic Trigger #9 Direction	SI
40330	Logic Trigger #10 Direction	SI
40334	Logic Trigger #11 Direction	SI
40338	Logic Trigger #12 Direction	SI
40342	Logic Trigger #13 Direction	SI
40346	Logic Trigger #14 Direction	SI
40350	Logic Trigger #15 Direction	SI
40354	Logic Trigger #16 Direction	SI
40358	Logic Trigger #17 Direction	SI
40362	Logic Trigger #18 Direction	SI
40366	Logic Trigger #19 Direction Read and Write: 0 for positive 1 for negative	SI
40295	Logic Trigger #1 Absolute	SI
40299	Logic Trigger #2 Absolute	SI
40303	Logic Trigger #3 Absolute	SI

40307	Logic Trigger #4 Absolute		SI
40311	Logic Trigger #5 Absolute		SI
40315	Logic Trigger #6 Absolute		SI
40319	Logic Trigger #7 Absolute		SI
40323	Logic Trigger #8 Absolute		SI
40327	Logic Trigger #9 Absolute		SI
40331	Logic Trigger #10 Absolute		SI
40335	Logic Trigger #11 Absolute		SI
40339	Logic Trigger #12 Absolute		SI
40343	Logic Trigger #13 Absolute		SI
40347	Logic Trigger #14 Absolute		SI
40351	Logic Trigger #15 Absolute		SI
40355	Logic Trigger #16 Absolute		SI
40359	Logic Trigger #17 Absolute		SI
40363	Logic Trigger #18 Absolute		SI
40367	Logic Trigger #19 Absolute		SI
40370	Logic Trigger #20 Direction		SI
40371	Logic Trigger #20 Absolute		SI
	Read and Write: 0 for disable		
	1 for enable		
40372-73	Power-On Threshold	R W	FP
GRP			
	Read and Write: 0.0 to 1.0		
40374-75	Power Hysteresis	R W	FP
GRP			
	Read and Write: 0.0 to 1.0		
40376-77	Quadrature Axis Compensation	R W	FP
GRP			
	Read and Write: 0.0 to 5.0		
40378-79	PSS Output Scale Constant	R W	FP
GRP			
	Read and Write: 0 to 200		
40380	PSS Software Switch 1	R W	SI
GRP			
40381	PSS Software Switch 2	R W	SI
GRP			
40382	PSS Software Switch 3	R W	SI
GRP			
40383	PSS Software Switch 4	R W	SI
GRP			
40384	PSS Software Switch 5	R W	SI
GRP			
40385	PSS Software Switch 6	R W	SI
GRP			
40386	PSS Software Switch 7	R W	SI
GRP			
40387	PSS Software Switch 8	R W	SI
GRP			
40388	PSS Software Switch 7	R W	SI
GRP			
40389	PSS Software Switch 8	R W	SI
GRP			
	Read and Write: 0 = off		
	1 = on		

40396-97 GRP	1 <sup>st</sup> Phase Lead Time Constant 1	R W	FP
40400-01 GRP	2 <sup>nd</sup> Phase Lead Time Constant 1	R W	FP
40404-05 GRP	3 <sup>rd</sup> Phase Lead Time Constant 1	R W	FP
40408-09 GRP	3 <sup>rd</sup> Phase Lead Time Constant 1	R W	FP
Read and Write: 0.01 to 6			
40398-99 GRP	1 <sup>st</sup> Phase Lag Time Constant 1	R W	FP
40402-03 GRP	2 <sup>nd</sup> Phase Lag Time Constant 1	R W	FP
40406-07 GRP	4 <sup>th</sup> Phase Lag Time Constant 1	R W	FP
40410-11 GRP	4 <sup>th</sup> Phase Lead Time Constant 1	R W	FP
Read and Write: 0.01 to 6			
40412 GRP	Sweep Type	R W	FP
Read and Write: 0 for disable, 1 for enable			
40413-14 GRP	Start Frequency	R W	FP
Read and Write: 0.0 to 20.0			
40415-16 GRP	Signal Sweep Frequency Step	R W	FP
Read and Write: 0.0 to 1			
40417-18 GRP	Signal End Frequency	R W	FP
Read and Write: 0.0 to 20.0			
40419 GRP	Signal Selection	R W	FP
Read and Write: 0,1,2,3, or 4			
40420-21 GRP	Signal Magnitude	R W	FP
Read and Write: 0.0 to 10.0			
40422-23 GRP	Signal Offset	R W	FP
Read and Write: 0.0 to 10.0			
40424-25 GRP	Signal Duration	R W	FP
Read and Write: 0.0 to 9990.0			
40426-27 GRP	Signal Frequency	R W	FP
Read and Write: 0.0 to 20.0			
40428 GRP	Test Switch 1	R W	MINT
40429 GRP	Test Switch 2	R W	MINT
40430 GRP	Test Switch 3	R W	MINT

40431	Test Switch 4	R W	MINT
GRP	Read and Write: 0 or 1		
40438-39	1 <sup>st</sup> Wash Timeout Constant	R W	FP
GRP			
40440-41	2 <sup>nd</sup> Wash Timeout Constant	R W	FP
GRP	Read and Write: 1 to 20		
40442-43	Torsional Filter 1 zeta num	R W	FP
GRP	Read and Write: 0 to 1		
40444-45	Torsional Filter 1 zeta den	R W	FP
GRP	Read and Write: 0 to 1		
40446-47	Torsional Filter 1 omega	R W	FP
GRP	Read and Write: 10 to 150		
40448-49	Torsional Filter 2 zeta num	R W	FP
GRP	Read and Write: 0 to 1		
40450-51	Torsional Filter 2 zeta den	R W	FP
GRP	Read and Write: 0 to 1		
40452-53	Torsional Filter 2 omega	R W	FP
GRP	Read and Write: 10 to 150		
40454-55	Washout Filter Normal Time	R W	FP
GRP	Read and Write: 5 to 30		
40456-57	Washout Filter Limit Time	R W	FP
GRP	Read and Write: 0 to 1		
40458-59	Logic Limit High Level	R W	FP
GRP	Read and Write: 0.01 to 0.04		
40460-61	Logic Limit Low Level	R W	FP
GRP	Read and Write: -0.04 to -0.01		
40462-63	Logic Limit Time Delay	R W	FP
GRP	Read and Write: 0 to 2		

Global Setting Parameters

40617	Test On Enable Switch		
	Read and Write:		
40618	Input 1 Contact Recognition Time Delay	SI	
40619	Input 1 Contact Debounce Time Delay	SI	
40620	Input 2 Contact Recognition Time Delay	SI	
40621	Input 2 Contact Debounce Time Delay	SI	
40622	Input 3 Contact Recognition Time Delay	SI	
40623	Input 3 Contact Debounce Time Delay	SI	
40624	Input 4 Contact Recognition Time Delay	SI	
40625	Input 4 Contact Debounce Time Delay	SI	
40626	Input 5 Contact Recognition Time Delay	SI	
40627	Input 5 Contact Debounce Time Delay	SI	
40628	Input 6 Contact Recognition Time Delay	SI	
40629	Input 6 Contact Debounce Time Delay	SI	
40630	Input 7 Contact Recognition Time Delay	SI	
40631	Input 7 Contact Debounce Time Delay	SI	
40632	Input 8 Contact Recognition Time Delay	SI	
40633	Input 8 Contact Debounce Time Delay	SI	
	Read and Write: 4 to 255 milliseconds		

40746-870	Contiguous Poll Block Assignments	INT
	Read and Write:	
	0 if Unassigned	
	1 to 9874: Holding Register 40001 to 49874	
40871	Setting Group Control On Time	INT
	Read and Write: 0 to 10 milliseconds	
40872	Setting Group 1 Automatic Control Switch Time	SI
40874	Setting Group 1 Automatic Control Return Time	SI
40878	Setting Group 2 Automatic Control Switch Time	SI
40880	Setting Group 2 Automatic Control Return Time	SI
40884	Setting Group 3 Automatic Control Switch Time	SI
40886	Setting Group 3 Automatic Control Return Time	SI
	Read and Write: 0 to 60 milliseconds	
40873	Setting Group 1 Automatic Control Switch Level	SI
40875	Setting Group 1 Automatic Control Return Level	SI
40879	Setting Group 2 Automatic Control Switch Level	SI
40881	Setting Group 2 Automatic Control Return Level	SI
40885	Setting Group 3 Automatic Control Switch Level	SI
40887	Setting Group 3 Automatic Control Return Level	SI
	Read and Write: 0 to 150%	
40876-77	Setting Group 1 Power Level	FP
40882-83	Setting Group 2 Power Level	FP
40888-89	Setting Group 3 Power Level	FP
	Read and Write: 0 to 5000 Megawatts	

#### Serial Port Setting Parameters

40962	Serial Port 0 Baud Rate	INT
40971	Serial Port 1 Baud Rate	INT
40980	Serial Port 2 Baud Rate	INT
	Read and Write:	
	0 – 300 Baud (Do not select for port 2 Modbus communications)	
	1 – 600 Baud (Do not select for port 2 Modbus communications)	
	2 – 1200 Baud	
	3 – 2400 Baud	
	4 – 4800 Baud	
	5 – 9600 Baud	
	6 – 19K Baud	
40963	Serial Port 0 Relay Address	INT
	Read and Write: 0 only	
40972	Serial Port 1 Relay Address	INT
40981	Serial Port 2 Relay Address	INT
	Read and Write: 0 to 65,534	
40964	Serial Port 0 Software Flow Control	SI
40973	Serial Port 1 Software Flow Control	SI
	Read:	
	0 if XON / XOFF Control is disabled	
	1 if XON / XOFF Control is enabled	
	Write:	
	0 to disable XON / XOFF Control	
	1 to 255 to enable XON / XOFF Control	
40982	Serial Port 2 Software Flow Control	SI
	Read and Write: 0 only (XON / XOFF Control fixed and disabled)	
40965	Serial Port 0 Page Length	SI
40974	Serial Port 1 Page Length	SI

	Read and Write:		
	0 for disabled		
	1 to 40 for number of lines / page		
40983	Serial Port 2 Page Length	SI	
	Not Supported		
40966	Serial Port 0 Acknowledgement Format	SI	
40975	Serial Port 1 Acknowledgement Format	SI	
	Read:		
	0 if No acknowledge		
	1 if Acknowledge enabled		
	Write:		
	0 for No acknowledge		
	1 to 255 to enable acknowledge		
40984	Serial Port 2 Acknowledgement Format	SI	
	Not Supported		
40967	Serial Port 0 Echo Control	SI	
40976	Serial Port 1 Echo Control	SI	
40985	Serial Port 2 Echo Control	SI	
	Not Supported		
40968	Serial Port 0 Modbus Parity	SI	
40977	Serial Port 1 Modbus Parity	SI	
	Not Supported		
40986	Serial Port 2 Modbus Parity	SI	
	Read and Write:		
	0 for No parity		
	1 for Even parity		
	2 for Odd parity		
40969	Serial Port 0 Modbus Remote Delay	SI	
40978	Serial Port 1 Modbus Remote Delay	SI	
	Not Supported		
40987	Serial Port 2 Modbus Remote Delay	SI	
	Read and Write:		
	1 to 20: 10 to 200 milliseconds		
40970	Serial Port 0 Modbus Stop Bits	SI	
40979	Serial Port 1 Modbus Stop Bits	SI	
	Not Supported		
40988	Serial Port 2 Modbus Stop Bits	SI	
	Read and Write:		
	1 for One stop bit		
	2 for Two stop bits		
	<u>System Data Setting Parameters</u>		
41019	System Frequency	SI	
	Read and Write:		
	50 for 50 Hertz		
	60 for 60 Hertz		
41020	Phase Rotation	SI	
	Read and Write:		
	1 for ABC		
	2 for ACB		
41021	Phase CT Ratio	INT	
41022	Phase VT Ratio	INT	
	Read and Write: 1 to 50,000		
41023	Phase VT Configuration		

Read and Write: 3 for 3 wire configuration  
4 for 4 wire configuration

41025-26 kV Voltage Rating  
Read and Write: 0.001 to 1,000.0

41027-28 MVA Voltamp Rating  
Read and Write: 0.001 to 100,000.0

Relay Data Setting Parameters

41265 Major Alarm Mask MSBs BM(16)  
41267 Minor Alarm Mask MSBs BM(16)  
41269 Logic Alarm Mask MSBs BM(16)

Read and Write:

Bits 15 to 8 - Spare  
Bit 7 – Login = None  
Bit 6 - Virtual Output 15 alarm  
Bit 5 - Virtual Output 14 alarm  
Bit 4 - Virtual Output 13 alarm  
Bit 3 - Setting Group Change Active alarm  
Bit 2 - Loss of IRIG-B sync or IRIG-B decode problem  
Bit 1 - An override is active in one or more outputs  
Bit 0 - EEPROM Non fatal error

41266 Major Alarm Mask LSBs BM(16)  
41268 Minor Alarm Mask LSBs BM(16)  
41270 Logic Alarm Mask LSBs BM(16)

Read and Write:

Bit 15 - User settings changed, ( 'EXIT' with 'Y' )  
Bit 14 - Power reset alarm, hard reset of MPU  
Bit 13 - Clock problem, real time clock has not been set  
Bit 12 - Communicating failure alarm, read error on serial port  
Bit 11 - Operating System Overload detected alarm  
Bit 10 - Setting group override in effect  
Bit 9 – Access lost alarm  
Bit 8 – New record alarm  
Bit 7 – Spare 4  
Bit 6 - Spare 3  
Bit 5 - Spare 2  
Bit 4 - Spare 1  
Bit 3 – PSS Current unbalance alarm  
Bit 2 – PSS Voltage unbalance alarm  
Bit 1 – PSS Speed failure alarm  
Bit 0 – PSS Threshold alarm

41272 Clock Format – Date ASC(1)  
Read and Write:  
M for mm/dd/yy format  
D for dd/mm/yy format

41273 Clock Format – Time SI  
Read and Write:  
12 for 12 hour clock  
24 for 24 hour clock

41274 Clock Format – Daylight Savings SI  
Read and Write:  
0 for disabling Daylight Savings  
1 for enabling Daylight Savings

41284 Output Hold Mask BM(8)  
Read and Write:

Bit 7 - Spare  
     Bit 6 - Output 6 Status  
     Bit 5 - Output 5 Status  
 Bit 4 - Output 4 Status  
 Bit 3 - Output 3 Status  
 Bit 2 - Output 2 Status  
 Bit 1 - Output 1 Status  
 Bit 0 - Output A Status

41286           Load Profile Interval           SI  
           Read and Write: 1 to 60

41287           Report Log Trigger Logic Mask

41301-02       Record Log Points Logic Mask  
           Read and Write: 0 to 20

41303-05       Record Log Points  
           Read and Write six 8 bit nos from 1 to 20. If less then 6 points end with 0.

41306-11       Reset Alarm Logic Mask           BM(96)

41314-19       Reset Alarm Logic Term           BM(96)

41322           Tune Mode  
           Read and Write: 0 for disabled  
                           1 for enabled

Custom Logic Setting Parameters

41465-68       User Custom Logic Name       ASC(8)  
           Read: If programming, reads custom logic name; otherwise, reads active standard logic name.  
           Write: New custom logic name or standard logic name of logic scheme to be copied to custom scheme.

41469-72       Current Active Logic Scheme   ASC(8)  
           Read: Current active logic name.  
           Write: Name of logic scheme to which you desire to change.

41473-76       Custom Logic Name           ASC(8)  
           Read: Custom logic name.

41477-80       Standard Logic #1 Name       ASC(8)  
           Read: Standard logic name #1.

41481-84       Standard Logic #2 Name       ASC(8)  
           Read: Standard logic name #2.

41485-88       Standard Logic #3 Name       ASC(8)  
           Read: Standard logic name #3.

41489-92       Standard Logic #4 Name       ASC(8)  
           Read: Standard logic name #4.

41493-96       Standard Logic #5 Name       ASC(8)  
           Read: Standard logic name #5.

41497-500      Standard Logic #6 Name       ASC(8)  
           Read: Standard logic name #6.

41501-04       Standard Logic #7 Name       ASC(8)  
           Read: Standard logic name #7.

System Labels And ID Setting Parameters

All are Read and Write of ASCII strings.

Report Parameters

47274-78	Model Number	ASC(10)
47282-89	Application SW Version # / Date	ASC(16)
47296-303	Boot SW Version # / Date	ASC(16)
47310-16	Serial Number	ASC(13)
47324-36	Style Number	ASC(21)
47346-53	DSP SW Version # / Date	ASC(16)
	Read Only: ASCII strings	
47362	COM1 Serial Port Relay Address	INT
47363	COM2 Serial Port Relay Address	INT
	Read and Write: 0 to 65,534	
47364	Date and Time – Day	INT
	Read and Write: any value (days since 01/01/1984).	
47365-66	Date and Time – Milliseconds	LI
	Read and Write: 0 to 86,399,999 milliseconds	
47367	System Status (Logic Var 0 to 15)	BM(16)
	Read only:	
	Bit 15 – Log Trigger Variable 16	
	Bit 14 - Log Trigger Variable 16	
	Bit 13 - Log Trigger Variable 14	
	Bit 12 - Log Trigger Variable 13	
	Bit 11 - Log Trigger Variable 12	
	Bit 10 - Log Trigger Variable 11	
	Bit 9 - Log Trigger Variable 10	
	Bit 8 - Log Trigger Variable 9	
	Bit 7 - Log Trigger Variable 8	
	Bit 6 - Log Trigger Variable 7	
	Bit 5 - Log Trigger Variable 6	
	Bit 4 - Log Trigger Variable 5	
	Bit 3 - Log Trigger Variable 4	
	Bit 2 - Log Trigger Variable 3	
	Bit 1 - Log Trigger Variable 2	
	Bit 0 - Log Trigger Variable 1	
47368	System Status (Logic Var 16 to 31)	BM(16)
	Read only:	
	Bit 15 - Logic always false	
	Bit 14 - Setting Group 3 active	
	Bit 13 - Setting Group 2 active	
	Bit 12 - Setting Group 1 active	
	Bit 11 - Setting Group 0 active	
	Bit 10 - 162 tripped	
	Bit 9 - 62 tripped	
	Bit 8 - Spare	
	Bit 7 - Fifth harmonic inhibit	
	Bit 6 - Second harmonic inhibit	
	Bit 5 - 87U tripped	
	Bit 4 - 87R tripped	
	Bit 3 - Log Trigger Variable 20	
	Bit 2 - Log Trigger Variable 19	
	Bit 1 - Log Trigger Variable 18	
	Bit 0 - Log Trigger Variable 17	
47369	System Status (Logic Var 32 to 47)	BM(16)
	Read only:	
	Bit 15 - Virtual Output 15 status	
	Bit 14 - Virtual Output 14 status	

Bit 13 - Virtual Output 13 status  
Bit 12 - Virtual Output 12 status  
Bit 11 - Virtual Output 11 status  
Bit 10 - Virtual Output 10 status  
Bit 9 - Virtual Output 9 status  
Bit 8 - Virtual Output 8 status  
Bit 7 - Virtual Output 7 status  
Bit 6 - Virtual Output 6 status  
Bit 5 - Virtual Output 5 status  
Bit 4 - Virtual Output 4 status  
Bit 3 - Virtual Output 3 status  
Bit 2 - Virtual Output 2 status  
Bit 1 - Virtual Output 1 status  
Bit 0 - Virtual Output A status

47370            System Status (Logic Var 48 to 63)            BM(16)

Read only:  
Bit 15 – Test Control  
Bit 14 – Spare3  
Bit 13 – Spare2  
Bit 12 – Spare1  
Bit 11 - Alarm logic  
Bit 10 - Alarm minor  
Bit 9 - Alarm major  
Bit 8 – PSS Control  
Bit 7 - Input 8 status  
Bit 6 - Input 7 status  
Bit 5 - Input 6 status  
Bit 4 - Input 5 status  
Bit 3 - Input 4 status  
Bit 2 - Input 3 status  
Bit 1 - Input 2 status  
Bit 0 - Input 1 status

47371            System Status (Logic Var 64 to 79)            BM(16)

Read only:  
Bit 15 - Spare 19  
Bit 14 - Spare 18  
Bit 13 - Spare 17  
Bit 12 - Spare 16  
Bit 11 - Spare 15  
Bit 10 - Spare 14  
Bit 9 - Spare 13  
Bit 8 - Spare 12  
Bit 7 - Spare 11  
Bit 6 - Spare 10  
Bit 5 - Spare 9  
Bit 4 - Spare 8  
Bit 3 - Spare 7  
Bit 2 - Spare 6  
Bit 1 - Spare 5  
Bit 0 – Spare 4

47372            System Status (Logic Var 80 to 95)            BM(16)

Read only:  
Bit 15 - 743  
Bit 14 - 643  
Bit 13 - 543  
Bit 12 - 443  
Bit 11 - 343  
Bit 10 - 243  
Bit 9 - 143

	Bit 8 - 43		
	Bit 7 - Spare 26		
	Bit 6 - Spare 25		
	Bit 5 - Test On		
	Bit 4 - Spare 24		
	Bit 3 - Spare 23		
	Bit 2 - Spare 22		
	Bit 1 - Spare 21		
	Bit 0 - Spare 20		
47373	Current Active Group Setting	SI	
	Read only: 0 to 3		
47374	Current Group Control Setting	ASC(1)	
	Read only: ASCII character 0, 1, 2, 3, L		
47375	Current Output Control Settings (OutputPulse0) MSBs		BM(16)
	Read only:		
	Bits 15 to 7 - Spare		
	Bit 6 - Output 6 pulse low		
	Bit 5 - Output 5 pulse low		
	Bit 4 - Output 4 pulse low		
	Bit 3 - Output 3 pulse low		
	Bit 2 - Output 2 pulse low		
	Bit 1 - Output 1 pulse low		
	Bit 0 - Output A pulse low		
47376	Current Output Control Settings (OutputPulse1) LSBs		BM(16)
	Read only:		
	Bits 15 to 7 - Spare		
	Bit 6 - Output 6 pulse high		
	Bit 5 - Output 5 pulse high		
	Bit 4 - Output 4 pulse high		
	Bit 3 - Output 3 pulse high		
	Bit 2 - Output 2 pulse high		
	Bit 1 - Output 1 pulse high		
	Bit 0 - Output A pulse high		
47377	Current Output Control Settings (OutputLatch0) MSBs		BM(16)
	Read only:		
	Bits 15 to 7 - Spare		
	Bit 6 - Output 6 latch low		
	Bit 5 - Output 5 latch low		
	Bit 4 - Output 4 latch low		
	Bit 3 - Output 3 latch low		
	Bit 2 - Output 2 latch low		
	Bit 1 - Output 1 latch low		
	Bit 0 - Output A latch low		
47378	Current Output Control Settings (OutputLatch1) LSBs		BM(16)
	Read only:		
	Bits 15 to 7 - Spare		
	Bit 6 - Output 6 latch high		
	Bit 5 - Output 5 latch high		
	Bit 4 - Output 4 latch high		
	Bit 3 - Output 3 latch high		
	Bit 2 - Output 2 latch high		
	Bit 1 - Output 1 latch high		
	Bit 0 - Output A latch high		
47379	Current Output Contact Status		BM(16)
	Read only:		



47486	Reset Logic Alarm Information	SI
47487	Reset Major Alarm Information	SI
47488	Reset Minor Alarm Information	SI
47489	Reset Relay Alarm Information	SI
47493	Clear Events Report	SI

Read: 0

Write: Any value will perform reset / trigger / clear.

*The following is the Report Template (RPT)*

47595-719 Report Text

Read only: ASCII string ( Illegal message response generated for invalid Report Focus value ).

Metering Parameters

49720 Part Number INT

Read only: 0 to 999

49726-27 Phase A Current Magnitude FP

49730-31 Phase B Current Magnitude FP

49734-35 Phase C Current Magnitude FP

49738-39 Positive Sequence Current Magnitude FP

49740-41 Negative Sequence Current Magnitude FP

49791-92 Generator Current FP

Read only: Value in Amps. If not applicable, reads undefined floating point value of 0xFFFFFFFF.

49728-29 Phase A Angle FP

49732-33 Phase B Angle FP

49736-37 Phase C Angle FP

Read only: -180 to 180 Degrees

49803-04 Phase A Voltage Magnitude FP

49807-08 Phase B Voltage Magnitude FP

49811-12 Phase C Voltage Magnitude FP

49815-16 Positive Sequence Voltage R - FP

49817-18 Negative Sequence Voltage R - FP

49789-90 Generator Voltage FP

Read only: Value in Volts. If not applicable, reads undefined floating point value of 0xFFFFFFFF.

49793-94 Generator Frequency R - FP

49795-96 Generator Compensated Frequency R - FP

Read only: Value in Hz

49797-98 Watts R - FP

Read only: Value in Watts

49799-800 Vars R - FP

Read only: Value in Vars

49801-02 Power Factor R - FP

Read only:

49805-06 Phase A Voltage Angle FP

49809-10 Phase B Voltage Angle FP

49813-14 Phase C Voltage Angle FP

Read only: -180 to 180 Degrees

49835-54 Error Details ASC(40)

Read only: ASCII string

49875-999 Contiguous Poll Block Mixed

Read Only: Mixed values.

## ASCII COMMAND VERSUS MODBUS REGISTER CROSS REFERENCE

ASCII COMMAND	MODBUS REGISTERS
A=<password>	40002-40005
CO-43	40120
CO-143	40122
CO-243	40124
CO-343	40126
CO-443	40128
CO-543	40130
CO-643	40132
CO-743	40134
CO-GROUP=<settings group>	40118
CO-OUT1	40142
CO-OUT2	40144
CO-OUT3	40146
CO-OUT4	40148
CO-OUT5	40150
CO-OUT6	40152
CO-OUTA	40140
CO-OUTALL	40138
CS-43	40119
CS-143	40121
CS-243	40123
CS-343	40125
CS-443	40127
CS-543	40129
CS-643	40131
CS-743	40133
CS-GROUP=<settings group>	40117
CS-OUT1	40141
CS-OUT2	40143
CS-OUT3	40145
CS-OUT4	40147
CS-OUT5	40149
CS-OUT6	40151
CS-OUTA	40139
CS-OUTALL	40137
EXIT	40001
GS-PWC=<Control password>,<Control path>	40090-40093,40094
GS-PWG=<Global password>,<Global path>	40080-40083,40084
GS-PWR=<Report password>,<Report path>	40095-40098,40099
GS-PWS=<Settings password>,<Settings path>	40085-40088,40089
M-IA	49726-49727,49728-49729
M-IB	49730-49731,49732-49733
M-IC	49734-49735,49736-49737
M-I1	49738-49739
M-I2	49740-49741
M-GV	49789-49790
M-GI	49791-49792
M-GF	49793-49794
M-GC	49795-49796
M-WATT	49797-49798
M-VAR	49799-49800
M-PF	49801-49802
M-VAN	49803-49804,49805-49806
M-VBN	49807-49808,49809-49810

ASCII COMMAND	MODBUS REGISTERS
M-VCN	49811-49812,49813-49814
M-V1	49815-49816
M-V2	49817-49818
RA-MAJ	47595-47719,40037
RA-MAJ=0	47487
RA-LGC	47595-47719,40037
RA-LGC=0	47486
RA-MIN	47595-47719,40037
RA-MIN=0	47488
RA-REL	47595-47719,40037
RA-REL=0	47489
RG-DATE=<date>	47364
RG-STAT	47367-47372
RG-TIME=<time>	47365-47366
RG-VER	47274-47278,47324-47334,47282-47289,47296-47303,47310-47316
RG-ADDR1	47362
RG-ADDR2	47363
RG-GRPACTIVE	47373
RG-GRPCNTRL	47374
RG-LOGIC	47389
RG-OUTCNTRL	47375-47376,47377-47378
RG-OUTSTAT	47379
RS	47595-47719,40037
RS-#	47595-47719,40037,40038
RS-NEW	47595-47719,40037
RS=0	47493
S#-62=<time delay 1>,<time delay2>	40269-40270,40271-40272
S#-162=<time delay 1>,<time delay2>	40273-40274,40275-40276
S#-LV1=<value>,<direction>,<abs>	40292-93,40294,40295
S#-LV2=<value>,<direction>,<abs>	40296-40297,40298,40299
S#-LV3=<value>,<direction>,<abs>	40300-40301,40302,40303
S#-LV4=<value>,<direction>,<abs>	40304-40305,40306,40307
S#-LV5=<value>,<direction>,<abs>	40308-40309,40310,40311
S#-LV6=<value>,<direction>,<abs>	40312-40313,40314,40315
S#-LV7=<value>,<direction>,<abs>	40316-40317,40318,40319
S#-LV8=<value>,<direction>,<abs>	40320-40321,40322,40323
S#-LV9=<value>,<direction>,<abs>	40324-40325,40326,40327
S#-LV10=<value>,<direction>,<abs>	40328-40329,40330,40331
S#-LV11=<value>,<direction>,<abs>	40332-40333,40334,40335
S#-LV12=<value>,<direction>,<abs>	40336-40337,40338,40339
S#-LV13=<value>,<direction>,<abs>	40340-40341,40342,40343
S#-LV14=<value>,<direction>,<abs>	40344-40345,40346,40347
S#-LV15=<value>,<direction>,<abs>	40348-40349,40350,40351
S#-LV16=<value>,<direction>,<abs>	40352-40353,40354,40355
S#-LV17=<value>,<direction>,<abs>	40356-40357,40358,40359
S#-LV18=<value>,<direction>,<abs>	40360-40361,40362,40363
S#-LV19=<value>,<direction>,<abs>	40364-40365,40366,40367
S#-LV20=<value>,<direction>,<abs>	40368-40369,40370,40371
S#-PWR=<power threshold>,<power hysteresis>	40372-40373, 40374-40375
S#-QCOMP=<quadrature axis compensation>	40376-40377
S#-SCALE=<output scale constant>	40378-40379
S#-SW0=<sw0>,<sw1>,<sw2>,<sw3>	40380,40381,40382,40383
S#-SW4=<sw4>,<sw5>,<sw6>,<sw7>	40384,40385,40386,40387
S#-SW8=<sw8>,<sw9>	40388,40389
S#-TCON=<1 <sup>st</sup> phase lead time const>,<1 <sup>st</sup> phase lag time const>,<	40396-40397,40398-40399,<

ASCII COMMAND	MODBUS REGISTERS
<2nd phase lead time const>, <2nd phase lag time const>, <3rd phase lead time const>, <3rd phase lag time const>	40400-40401, 40402-40403, 40404-40405, 40406-40407
S#TCON2=<4 <sup>th</sup> phase lead time const >, <4 <sup>th</sup> phase lag time const>	40408-40409, 40410,40411
S#-TFREQ=<sweep>,<start>,<step>,<end>	40412,40413-40414,40415-40416,40417-40418
S#-TSIG=<sig sel>,<sig mag>,<sig offset>,<sig duration>,<sig freq>	40419,40420-40421,40422-40423,40424-40425,40426-40427
S#-TSW=<test sw1>,<test sw2>,<test sw3>,<test sw4>	40428,40429,40430,40431
S#-WASH=<1 <sup>st</sup> wash timeout const><2 <sup>nd</sup> wash timeout const>	40438-40439,40440-40441
S#-TFLT1=<z1n>,<z1d>,<wn1>	40442-40443, 40444-40445, 40446-40447
S#-TFLT2=<z2n>,<z2d>,<wn2>	40448-40449, 40450-40451, 40452-40453
S#-TW5=<tw5_nrl>,<t<w5_lmt>	40454-40455, 40456-40457
S#-LLG=<lmt_vhi>,<lmt_vlo>,<lmt_dly>	40458-40459, 40460-40461, 40462-40463
S#-LIM=<stabilizer upper limit>,<stabilizer lower limit>	40286-40287,40288-40289
S#-LPF=<mech pwr low pass filter time const>	40290-40291
S#-CNTL=<PSS control>	40277
S#-ET=<ET time limiter const>,<ET limiter set point>	40278-40279,40280-40281
S#-H=<unit inertia setting>	40282-40283
S#-KS=<stabilizer gain const>	40284-40285
ST-ON=<test on enable switch>	40617
SA-LGC=<alarm number>	41269-41270
SA-MAJ=<alarm number>	41265-41266
SA-MIN=<alarm number>	41267-41268
SA-RESET=<reset Alarm Logic>	41306-41311,41314-41319
SG-CLK=<date format>,<time format><dst enable>	41272,41273,41274
SG-COM0=<baud rate>,<flow control>,<page length>,<ack>	40962,40964,40965,40966
SG-COM1=<baud rate>,<relay address>,<flow control>,<page length>,<ack>	40971,40972,40973,40974,40975
SG-COM2=<baud rate>,<relay address>,,,,<parity>,<remote delay>,<stop bits>	40980,40981,40986,40987,40988
SG-CT=<ratio>	41021
SG-VT=<ratio>,<config>	41022,41023
SG-FREQ=<frequency>	41019
SG-HOLD=<output hold enable>	41284
SG-ID1=<relay ID>	43438-43452
SG-ID2=<station ID>	43453-43467
SG-ID3=<station ID>	43476-43482
SG-ID4=<station ID>	43483-43497
SG-IN1=<input recognition>,<input debounce >	40618,40619
SG-IN2=<input recognition>,<input debounce >	40620,40621
SG-IN3=<input recognition>,<input debounce >	40622,40623
SG-IN4=<input recognition>,<input debounce >	40624,40625
SG-IN5=<input recognition>,<input debounce >	40626,40627
SG-IN6=<input recognition>,<input debounce >	40628,40629
SG-IN7=<input recognition>,<input debounce >	40630,40631
SG-IN8=<input recognition>,<input debounce >	40632,40633
SG-PHROT=<rotation sequence>	41020
SG-SGCON=<time>	40871
SG-TRIG=<trigger logic>	41287-41292,41295-41300
SG-KV=<KV voltage rating>	41025-41026
SG-MVA=<MVA voltamp rating>	41027-41028
SG-LOG=<record log points>,<load profile interval>	41303-41305,41286

ASCII COMMAND	MODBUS REGISTERS
SG-TUNE=<tune mode>	41322
SL-43=<mode>	42091
SL-143=<mode>	42092
SL-243=<mode>	42093
SL-343=<mode>	42094
SL-443=<mode>	42095
SL-543=<mode>	42096
SL-643=<mode>	42097
SL-743=<mode>	42098
SL-62=<mode>,<ini logic equation>,<block logic equation>	41508,41509-41514,41517-41522,41525-530,41533-41538
SL-162=<mode>,<ini logic equation>,<block logic equation>	41541,41542-41547,41550-41555,41558-563,41566-41571
SL-PSS=<mode>,<control logic>,<test logic>	41574,41575-41580,41583-41588,41591-41596,41599-41604
SL-GROUP=<mode>,<D0 logic equation>,<D1 logic equation>,<D2 logic equation>,<D3 logic equation>,<auto logic equation>	42010,42027-42032,42035-42040,42043-42048,42051-42056,42059-42064,42067-42072,42075-42080,42083-42088,42011-42016,42019-42024
SL-N=<name>	41465-41468
SL-OP=<mode>,<motor mode logic>,<ph. seq. logic>	41607, 41608-41613, 41616-41621, 41624-41629, 41632-41637
SL-VOA=<boolean logic equation>	42133,42134-42139,42142-42147,42150-42155,42158-42163,42166-42171,42174-42179,42182-42187,42190-42195
SL-VO1=<boolean logic equation>	42198,42199-42204,42207-42212,42215-42220,42223-42228,42231-42236,42239-42244,42247-42252,42255-42260
SL-VO2=<boolean logic equation>	42263,42264-42269,42272-42277,42280-42285,42288-42293,42296-42301,42304-42309,42312-42317,42320-42325
SL-VO3=<boolean logic equation>	42328,42329-42334,42337-42342,42345-42350,42353-42358,42361-42366,42369-42374,42377-42382,42385-42390
SL-VO4=<boolean logic equation>	42393,42394-42399,42402-42407,42410-42415,42418-42423,42426-42431,42434-42439,42442-42447,42450-42455
SL-VO5=<boolean logic equation>	42458,42459-42464,42467-42472,42475-42480,42483-42488,42491-42496,42499-42504,42507-42512,42515-42520
SL-VO6=<boolean logic equation>	42523,42524-42529,42532-42537,42540-42545,42548-42553,42556-42561,42564-42569,42572-42577,42580-42585
SL-VO7=<boolean logic equation>	42588,42589-42594,42597-42602,42605-42610,42613-42618,42621-42626,42629-42634,42637-42642,42645-42650
SL-VO8=<boolean logic equation>	42653,42654-42659,42662-42667,42670-42675,42678-42683,42686-42691,42694-42699,42702-42707,42710-42715
SL-VO9=<boolean logic equation>	42718,42719-42724,42727-42732,42735-42740,42743-42748,42751-42756,42759-42764,42767-42772,42775-42780
SL-VO10=<boolean logic equation>	42783,42784-42789,42792-42797,42800-42805,42808-42813,42816-42821,42824-42829,42832-42837,42840-42845
SL-VO11=<boolean logic equation>	42848,42849-42854,42857-42862,42865-42870,42873-42878,42881-42886,42889-42894,42897-42902,42905-42910

ASCII COMMAND	MODBUS REGISTERS
SL-VO12=<boolean logic equation>	42913,42914-42919,42922-42927,42930-42935,42938-42943,42946-42951,42954-42959,42962-42967,42970-42975
SL-VO13=<boolean logic equation>	42978,42979-42984,42987-42992,42995-43000,43003-42008,43011-43016,43019-42024,43027-42032,43035-42040
SL-VO14=<boolean logic equation>	43043,43044-42049,43052-42057,43060-42065,43068-42073,43076-43081,43084-42089,43092-42097,43100-42105
SL-VO15=<boolean logic equation>	43108,43109-42114,43117-42122,43125-42130,43133-42138,43141-43146,43149-42154,43157-42162,43165-42170
SL: <custom logic>,<logic1>,<logic2>,<logic3>,<logic4>,<logic5>,<logic6>,<logic7>	41473-41476,41477-41480,41481-41484,41485-41488, 41489-41492,41493-41496,41497-41500, 41501-41504
SN-43=<name>,<true label>,<false label>	43498-43505,43506-43509,43510-43513
SN-143=<name>,<true label>,<false label>	43514-435218,43522-43525,43526-43529
SN-243=<name>,<true label>,<false label>	43530-43537,43538-43541,43542-43545
SN-343=<name>,<true label>,<false label>	43546-43553,43554-43557,43558-43561
SN-443=<name>,<true label>,<false label>	43562-43569,43570-43573,43574-43577
SN-543=<name>,<true label>,<false label>	43578-43585,43586-43589,43590-43593
SN-643=<name>,<true label>,<false label>	43594-43601,43602-43605,43606-43609
SN-743=<name>,<true label>,<false label>	43610-43617,43618-43621,43622-43625
SN-VOA=<name>,<true label>,<false label>	43626-43633,43634-43637,43638-43641
SN-VO1=<name>,<true label>,<false label>	43642-43649,43650-43653,43654-43657
SN-VO2=<name>,<true label>,<false label>	43658-43665,43666-43669,43670-43673
SN-VO3=<name>,<true label>,<false label>	43674-43681,43682-43685,43686-43689
SN-VO4=<name>,<true label>,<false label>	43690-43697,43698-43701,43702-43705
SN-VO5=<name>,<true label>,<false label>	43706-43716,43714-43717,43718-43721
SN-VO6=<name>,<true label>,<false label>	43722-43729,43730-43733,43734-43737
SN-VO7=<name>,<true label>,<false label>	43738-43745,43746-43749,43750-43753
SN-VO8=<name>,<true label>,<false label>	43754-43761,43762-43765,43766-43769
SN-VO9=<name>,<true label>,<false label>	43770-43777,43778-43781,43782-43785
SN-VO10=<name>,<true label>,<false label>	43786-43793,43794-43797,43798-43801
SN-VO11=<name>,<true label>,<false label>	43802-43809,43810-43813,43814-43817
SN-VO12=<name>,<true label>,<false label>	43818-43825,43826-43829,43830-43833
SN-VO13=<name>,<true label>,<false label>	43834-43841,43842-43845,43846-43849
SN-VO14=<name>,<true label>,<false label>	43850-43857,43858-43861,43862-43865
SN-VO15=<name>,<true label>,<false label>	43866-43873,43874-43877,43878-43881
SN-IN1=<name>,<true label>,<false label>	43882-43889,43890-43893,43894-43897
SN-IN2=<name>,<true label>,<false label>	43898-43905,43906-43909,43910-43913
SN-IN3=<name>,<true label>,<false label>	43914-43921,43922-43925,43926-43929
SN-IN4=<name>,<true label>,<false label>	43930-43937,43938-43941,43942-43945
SN-IN5=<name>,<true label>,<false label>	43946-43953,43954-43957,43958-43961
SN-IN6=<name>,<true label>,<false label>	43962-43969,43970-43973,43974-43977
SN-IN7=<name>,<true label>,<false label>	43978-43985,43986-43989,43990-43993
SN-IN8=<name>,<true label>,<false label>	43994-44001,44002-44005,44006-44009
SP-LOGIC=<active logic scheme>	41469-41472
SP-GROUP1=<switch time>,<switch level>,<return time>,<return level>,<pwr level>	40872,40873,40874,40875,40876-40877
SP-GROUP2=<switch time>,<switch evel>,<return time>,<return level>,<pwr level>	40878,40879,40880,40881,40882-40883
SP-GROUP3=<switch time>,<switch evel>,<return time>,<return level>,<pwr level>	40884,40885,40886,40887,40888-40889





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