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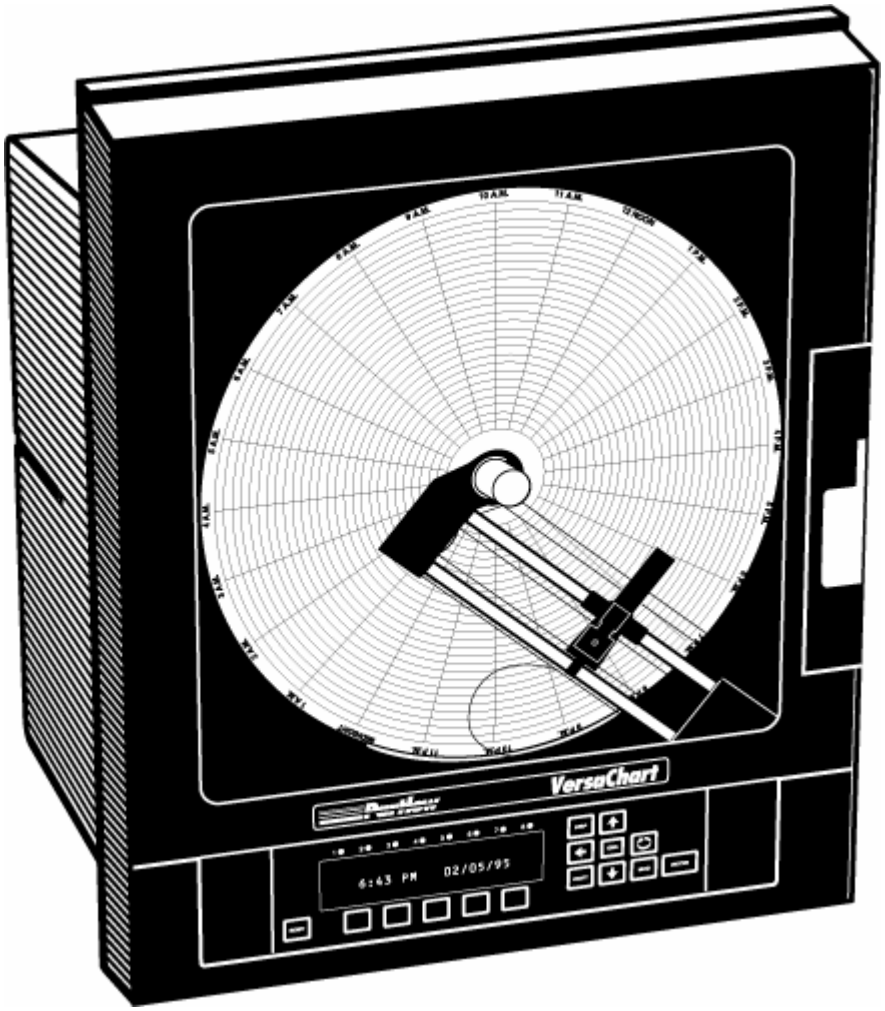
VersaChart

MODBUS RTU Communication Protocol



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PREFACE

For high level users who are using a MMI (Man Machine Interface) or SCADA (Supervisory Control And Data Acquisition) program, the appendixes identify all register assignments and data types, which supply all the needed information for interfacing with the instrument's parameters.

For the low level user who will be developing a communication software program, the main portion of this manual will address the message framing and construction, instrument addressing, and all other pertinent details. Familiarity with communications and your network is assumed.

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If you have any suggestions for improvements, or find any errors in this publication, please notify us.

Contents

SECTION 1.0 - INTRODUCTION

This document specifies the MODBUS communications protocol as implemented on the Versa Chart, or other applicable Partlow instruments. Source material for this manual is the Modicon MODBUS Protocol Reference Guide PI-MBUS-300, Rev. F.

For the high level user who is using a MMI (Man Machine Interface) program, all you will need to use is the appendixes to identify all the instruments register assignments and data types.

For the low level user developing a communication software program, this manual will address the message framing and construction, instrument addressing, and all other pertinent information.

This manual does not try to be a complete guide to the MODBUS protocol, but will show how to structure a message that the Partlow instruments will recognize, how to request access to another device, and how errors will be detected and reported.

1.1 SERIAL COMMUNICATION INTERFACING

RS-485 serial communications is an option that can be provided on Partlow Instruments. The VersaChart can be configured for RS-485 or RS-232.

RS-485 is used in a multi-drop network over a two-wire bus. RS-485 can typically be used in distances up to 4000 feet, where RS-232 is used in distances up to 50 feet and can not be used in a multi-drop network.

Partlow instruments communicate using a master-slave technique, in which only one device is the master and the slave devices supply the requested data when addressed. Typical master devices can be a host computer, or PLC (programmable logic controller), or a VersaChart.

1.2 MODBUS MESSAGE FRAMING

There are two serial transmission modes for the MODBUS protocol, ASCII or RTU (Remote Transmission Unit) framing. The Partlow instruments use the **RTU** framing method **only**. The MODBUS message is placed by the transmitting device into a frame that has a known beginning and ending point. This allows receiving devices to begin at the start of the message, read the address portion and determine which device is addressed, and know when the message is completed. Partial messages can be detected and errors can be set as a result.

1.3 RTU FRAMING

In RTU framing mode, the message starts with a silent interval of at least 3.5 character times. This is most easily implemented as a multiple of character times at the baud rate that is going to be used in the network. The first field then transmitted is the device address. Binary data is used for transmission for all fields. Network devices monitor the network bus continuously, including the “silent” interval. When the first field is received, each device decodes it to find out if it is being addressed.

Following the last transmitted character, a similar ‘silent’ interval of at least 3.5 character times marks the end of the message. A new message can then begin after this interval.

The entire message frame must be transmitted as a continuous stream. If a ‘silent’ interval of more than 1.5 character times occurs before completion of the frame, the receiving device discards the incomplete message and assumes the next byte will be the address field of a new message.

If a new message begins earlier than 3.5 character times following a previous message, the receiving device will consider it a continuation of the previous message. This will cause an error, as the value in the final CRC field will not be valid for the combined messages.

A typical message frame is shown below :

START	ADDRESS	FUNCTION	DATA	CRC	END
T1-T2-T3-T4	8 BITS	8 BITS	n X 8 BITS	16 BITS	T1-T2-T3-T4

***Note: All bytes are a total of 11 bits long. See Bits per Byte below.**

1.4 RTU MODE

The main advantage of the RTU mode is that its greater character density allows better data throughput than ASCII for the same baud rate. Each message must be transmitted in a continuous stream.

The format for each byte in RTU mode is:

Coding System: 8-bit binary

Bits per Byte: 1 start bit
8 data bits, least significant bit sent first
1 bit for even/odd parity; no bit for no parity
1 stop bit if parity is used; 2 bits if no parity

Baud Rate: 1200, 2400, 4800, and 9600

Error Check Field: Cyclical Redundancy Check (CRC)

1.5 CONTENTS OF THE DATA FIELD

The data field of messages sent from a master to a slave device contains additional information which the slave must use to take the action defined by the function code. This can include items like register addresses, the quantity of items to be handled, and the count of actual data bytes in the field.

For example, if the master requests a slave to read a group of holding registers (function code 03), the data field specifies the starting register and how many registers are to be read. If the master writes to a group of registers in the slave (function code 16), the data field specifies the starting register, how many registers to write, the count of data bytes to follow in the data field, and the data to be written in the registers.

If no error occurs, the data field of a response from a slave to a master contains the data re-quested. If an error occurs, the field contains an exception code that the master application can use to determine the next action to be taken.

1.6 DATA TYPES COMMUNICATED

Based upon the instrument data types, and Modbus protocol documentation, the following will be the allowed data types communicated:

Bits for digital status states
Two-byte integer values in the range of -32,767 to +32,767
Four-byte integer values in the range of -2,147,483,647 to +2,147,483,647
Four-byte floating point values in the range of -/+1E-37 to -/+1E+37
Multiple-byte ASCII text strings

Choices are communicated as two-byte integer values. **See Appendix A for more details.**

SECTION 2.0 - MODBUS FUNCTIONS

The following is a list the functions to be supported. The JBUS names are listed first, where such an equivalence exists, as these more closely represent the actual operations. The original Gould MODBUS function names are listed for reference. The MODBUS Function number follows the names. In some cases two function numbers will be supported, as they could be used interchangeably with respect to our unit.

JBUS	*MODBUS*	*FUNCTION NUMBER*	
A.	Read n Bits	Read Coil Status	01
	Read Input Status		02
B.	Read n Words	Read Holding Registers	03
	Read Input Registers		04
C.	Write 1 Bit	Force Single Coil	05
D.	Write 1 Word	Preset Single Register	06
E.	Loopback Test	Loopback Diagnostic Test	08
F.	Parameter Reset	Parameter reset for VersaChart	08*
G.	Write n Words	Preset Multiple Registers	16

*** Note: Parameter reset is an additional Modbus code used on the VersaChart only, which is a reset command, which will set all the VersaChart's configuration parameters to default values.**

SECTION 3.0 - MODBUS MESSAGE FORMATS

The first character of each message is an instrument address. The valid range of such an address is 0 to 247. The second character is always the function number. The contents of the remainder of the message depends upon the function number. The maximum length of a message is 256 bytes.

In most cases the instrument is required to reply by echoing the address and function number, together with an echo of all or part of the message received (in the case of a request to write a value or carry out a command) or the information requested (in the case of a read parameter operation). Broadcast Messages (to which the instrument responds by taking some action without sending back a reply) are supported at instrument address zero. Commands which can be broadcast are so noted.

For VersaChart only - If you are developing a configurator program or have a **single** Versa-Chart in your network, you can use address 248. This is a secondary address for all Versa-Charts, to which they will always respond, regardless of their primary communication address. **Do not use address 248 in a network consisting of more than 1 VersaChart!**

A message is terminated solely by a delay of at least 3.5 character lengths at the given baud rate, and any character received after such a delay is treated as a potential address at the start of a new message.

Since only the RTU form of the protocol is being supported, each message contains binary data values and is followed by a two-byte CRC16. This is a 16-bit cyclic redundancy check-sum. It is calculated in accordance with a formula which involves recursive division of the data by a polynomial, with the input to each division being the remainder of the results of the previous one. Details of how the checksum must be calculated can be found in Modicon MODBUS Protocol Reference Guide PI-MBUS-300.

The following abbreviations or designations are used in specifying the message formats:

IA	Instrument Address
FN	Function Number
PCH	Parameter Code High
PCL	Parameter Code Low
NBH	Number of Bits High
NBL	Number of Bits Low
NWH	Number of Words High
NWL	Number of Words Low
COUNT	Number of bytes of data
CRCH	CRC16 - Cyclic Redundancy Check Value High
CRCL	CRC16 - Cyclic Redundancy Check Value Low

In depicting message formats, parenthesis are used to represent a byte of data. The general format of the message sent to the instrument will consist of 8 or more bytes, consisting of a "standard preamble" (IA and FN bytes), data (dependent on the function), and a CRC16 as follows:

(IA) (FN) (data) (data) (data) (data) . . . . . (CRCL) (CRCH)

The MODBUS documentation refers to a Starting Address as the pointer to Coil or Input Bits, or Holding or Input Registers. These really do not correspond to addresses in the real sense. They will be referred to as Parameter Codes in this document. Parameter Code is a more appropriate term than Parameter Number, as the value is really a combination of numbers that point to a specific parameter within a group of parameters, e.g. Input Parameters, Input 3, Input Type.

3.1 Read n Bits - Function Number 01/02

The message sent to the instrument will consist of 8 bytes consisting of the standard pre-amble, followed by the parameter code of the first data bit to be read, and the two-byte bit count to be read, as follows:

(IA) (1 or 2) (PCH) (PCL) (NBH) (NBL) (CRCL) (CRCH)

The normal reply will echo the first 2 characters of the message received, and will then contain a single-byte data byte count, which will not include itself or the CRC. For this message, there will be one byte of data per eight bits-worth of information requested, with the LSB of the first data byte transmitted depicting the state of the lowest-numbered bit parameter required.

(IA) (FN) (COUNT) (8 bits) (8 bits) (etc.) . . . (last 8 bits) (CRCL) (CRCH)

This function will be used largely to report instrument status information, such as local/remote or auto/manual status, and so a bit set to 1 indicates that the corresponding feature is currently enabled/active/true, and a bit reset to 0 indicates the opposite. If an exact multiple of eight bits is not requested, the data is padded with trailing zeros to preserve the 8-bit format.

3.2 Read n Words - Function Number 03/04

The message sent to the instrument will consist of 8 bytes consisting of the standard preamble, followed by the parameter code of the first parameter to be read, and the two-byte word count to be read, as follows:

(IA) (3 or 4) (PCH) (PCL) (NWH) (NWL) (CRCL) (CRCH)

The reply sent by the instrument echoes the first two characters received and then contains a single-byte data byte count, the value of which does not include either itself or the CRC value to be sent. For this message, the count equals the number of words read times two. Following the byte count, the number of bytes are transmitted, MSB first, followed by the CRC16.

(IA) (FN) (COUNT) (HI) (LO) (HI) (LO) (etc.) (etc.). . . (last HI) (last LO) (CRCL) (CRCH)

3.3 Write 1 Bit - Function Number 05

The message sent to the instrument will consist of 8 bytes consisting of the standard preamble, followed by the parameter code of the bit to set and a two-byte word whose MSB contains the desired truth value of the bit, expressed as 0xFF (TRUE) or 0x00 (FALSE), as follows:

(IA) (5) (PCH) (PCL) (State) (0) (CRCL) (CRCH)

Generally, this function will be used to control such features as auto/manual. The normal reply sent by the instrument will be a byte-for-byte echo of the message received.

(IA) (5) (PCH) (PCL) (State) (0) (CRCL) (CRCH)

3.4 Write 1 Word - Function Number 06

The message sent to the instrument will consist of 8 bytes consisting of the standard preamble, followed by the parameter code of the parameter to be written, and the two-byte value to which the parameter will be set, as follows:

(IA) (6) (PCH) (PCL) (Value HI) (Value LO) (CRCL) (CRCH)

The normal response is to echo the message in its entirety.

3.5 Write n Words - Function Number 16

The message sent to the instrument will consist of 11 or more bytes consisting of the standard preamble, followed by the parameter code of the first parameter to be written, a two-byte word count, a one-byte byte COUNT, and the series of two-byte words to which the parameters will be set.

(IA) (16) (PCH) (PCL) (NWH) (NWL) (COUNT) (Word HI) (Word LO)
(Word HI) (Word LO) . . . . . (Word HI) (Word LO) (CRCL) (CRCH)

The instrument normally responds with a 8 byte reply, as follows:

(IA) (16) (PCH) (PCL) (NWH) (NWL) (CRCL) (CRCH)

3.6 Loopback Diagnostic Test - Function Number 08

The message sent to the instrument will consist of 8 bytes consisting of the standard preamble, followed by a four bytes of zeros, as follows:

(IA) (8) (0) (0) (0) (0) (CRCL) (CRCH)

Full MODBUS support in this area is not appropriate - consequently, the diagnostic code supported is code 0000. In response to the message the instrument must echo the message received exactly.

3.7 *Parameter Reset - Function Number 08 – (VersaChart Only)

There is an additional Modbus code used on the **VersaChart only,** which is a reset command, which will set all the VersaChart's configuration parameters to default values.

The message sent to the instrument will consist of 8 bytes consisting of the standard preamble, followed by a four bytes, three of zeros and the last one a 10, as follows:

(IA) (8) (0) (0) (0) (10) (CRCL) (CRCH)

3.8 Error and Exception Responses

If the instrument receives a message which contains a corrupted character (parity check fail, framing error. etc.), or if the CRC16 check fails, the instrument ignores the message. If the message is otherwise syntactically flawed (e.g. the byte count or word count is incorrect) the instrument will also not reply.

If the instrument receives a syntactically correct message which contains an illegal value, it will send an exception response, consisting of five bytes as follows:

(IA) (FN) (Exception Number) (CRCL) (CRCH)

The Function Number field consists of the function number contained in the message which caused the error, with its most significant bit set (i.e. function 3 becomes x83), and the Exception Number is one of the codes contained in the following table:

Code	*Error Name*	*Cause*
1	ILLEGAL FUNCTION	Function number out of range
2	ILLEGAL DATA ADDRESS	Parameter ID out of range or not supported
3	ILLEGAL DATA VALUE	Attempt to write invalid data or not enough data words
4	DEVICE FAILURE	Slave Error
5	ACKNOWLEDGE	N/A
6	BUSY	Request is out of context for current VersaChart state
7	NEGATIVE ACKNOWLEDGE	N/A

SECTION 4.0 - PARAMETER VALUE COMMUNICATED

There are three different types of parameter values, Bit parameter, Single parameter, and Multiple parameter values.

4.1 Bit Parameter Communications

The bit parameters are fairly straight forward. The bits are accessed and transmitted per the protocol while they are stored in the instrument as one-byte entities.

The computer can read single or multiple bits using Function Numbers 01 or 02. The computer can write a single bit using Function Number 05. We do **not** support multiple bit writes via Function Number 15, as this is seldom done in real world applications and MMI or SCADA programs don't always support it either.

4.2 Single Parameter Value Communications

The two-byte integer values are straight forward. Values are stored, accessed, transmitted and treated simply as two-byte or word oriented entities.

Four-byte integer values and four-byte floating point values are not as simple. They must be treated as two consecutive "registers". The computer must read or write the two consecutive registers, using Function Numbers 03/04 or 16. Otherwise, the instrument will not accept the command and will respond with an Exception Code of 3, ILLEGAL DATA VALUE.

Multiple-byte ASCII text data is a bit more complex. Each string must be treated as consecutive registers. The computer must read or write the correct number of consecutive registers, using Function Numbers 03/04 or 16. Otherwise, the instrument will not accept the command and will respond with an Exception Code of 3, ILLEGAL DATA VALUE.

4.3 Multiple Parameter Value Communications

In addition to being able to read or write any one of the data types in a single operation, Function Numbers 03/04 or 16 can be used to read or write a series of consecutive registers that correspond to any mix of data types, provided the number of consecutive registers falls on a parameter boundary. Otherwise, the instrument will not accept the command and will respond with an Exception Code of 3, ILLEGAL DATA VALUE. To simplify coding, the instruments will process data in order of occurrence, and only not accept/process the command for the last parameter if it does not fall on the end of the parameter boundary.

SECTION 5.0 -PARAMETER CODES

The MODBUS numbering system splits parameters into bits and registers (or words) and numbers each group independently.

5.1 MODBUS Register Assignments Format

Word or Register numbers can range from 0 to 65,536 or -32,768 to 32,767. The unsigned format will be used.

For the sake of organization, user recognition, ability to access sets of parameters, and ability to add more parameters to a group of parameters, the Register numbers have been broken into decimal digits and will be referenced as SSGRR, where:

SS is Section corresponding to the prompting sections, but includes other sets of parameters
G is the Group of parameters, e.g. Input 3 versus Input 2,
RR is the Register number within the group.

Sections will be numbered from zero, while Groups and Registers will be numbered from one.
Using this scheme, due to the limit of five digits, it is not possible to have more than 66 Sections (0 to 65) and more than 10 Groups (0 to 9). Therefore, where there are more than 10 Groups (as with 12 Derived Variables), multiple Sections will be used. The first Section assigned will provide access to Groups 1 through 9, the second Section assigned will provide access to Groups 10 through 19, etc.

Note that this provides access to 99 "Registers" within a Group, not 99 "Parameter values".

Refer to APPENDIX A for a all VersaChart Register assignments.

SECTION 6.0 - EXAMPLES

The Real Time Values registers will be used in this example. The following table identifies the data needed to implement the protocol, the data type, number of internal bytes used, and limits are information already available within the instrument. The only additional information required that needs to be incorporated is the correlation of the **SSGRR** register designation to the particular parameter. **(See Section 6)**

A register address represents data up to 2 bytes long. Thus items longer than 2 bytes require more than one register number to represent them. These numbers are always sequential, starting from the value in the **'SS G RR'** column, and the item is always referred to via the first number.

An example of the real time input value registers:

Section 01: Real Time Values (partial listing)

SS G RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
01 1 01	2	F	INPUT VALUE 1	
01 1 03	2	F	INPUT VALUE 2	
01 1 05	2	F	INPUT VALUE 3	
01 1 07	2	F	INPUT VALUE 4	
01 1 09	2	F	INPUT VALUE 5	
01 1 11	2	F	INPUT VALUE 6	
01 1 13	2	F	INPUT VALUE 7	
01 1 15	2	F	INPUT VALUE 8	
01 2 01	2	F	PROCESS VARIABLE 1	

REG refers to how many registers are being used.

TYPE refers to the data type :
B = Digital bit values - one bit
I = Integer values - two byte integer in the range of -32,767 to +32,767
L = Long Values - four byte integer in the range of -2,147,483,647 to +2,147,483,647
T = ASCII Text - multiple byte ASCII text strings
F = Floating Point values - four byte floating point values in the range of +/- 1E-37 to +/- 1E+37
C = Choice - Refer to the appropriate CHOICE table in Appendix B

Read Example # 1 :

An example on how to read the real time measured value of **INPUT 2** is as followed:

SS G RR = 01 1 03

Note:(RR = 03 for INPUT 2, because INPUT 1 takes two registers, 01 and 02, it is a floating point value)
The message sent to an instrument at communication address 5 would be as follows:

	(IA)	(FN)	(High byte of 01103)	(Low byte of 01103)	(NWH)	(NWL)	(CRCL)	(CRCH)
Hex out:	(05)	(03)	(04)	(4F)	(00)	(02)	(5F)	(68)

If INPUT 2's value was 86.69925 at the time you should receive**:**

	(IA)	(FN)	(count)	(1st value)	(2nd value)	(3rd Value)	(Last Value)	(CRCL)	(CRCH)
Hex in:	(05)	(03)	(04)	(42)	(AD)	(66)	(04)	(10)	(09)

Read Example # 2 :

An example on how to read the real time measured value of **Total 1** is as followed:

SS G RR = 01 4 01

The message sent to an instrument at communication address 2 would be as follows:

	(IA)	(FN)	(Hi byte of 01401)	(Low byte of 01401)	(NWH)	(NWL)	(CRCL)	(CRCH)
Hex out:	(02)	(03)	(05)	(79)	(00)	(02)	(15)	(2D)

If Total 1's value was 2,484 at the time you should receive**:**

	(IA)	(FN)	(count)	(1st value)	(2nd value)	(3rd Value)	(Last Value)	(CRCL)	(CRCH)
Hex in:	(02)	(03)	(04)	(00)	(00)	(09)	(B4)	(CF)	(14)

Read Example # 3 :

An example on how to read the display format of the VersaChart is as followed:

SS G RR = 02 1 01

The message sent to an instrument at communication address 1 would be as follows:

	(IA)	(FN)	(Hi byte of 00101)	(Low byte of 00101)	(NWH)	(NWL)	(CRCL)	(CRCH)
Hex out:	(01)	(03)	(08)	(35)	(00)	(01)	(96)	(64)

If the display format was continuous mode, you should receive**:**

	(IA)	(FN)	(count)	(1st value)	(Last Value)	(CRCL)	(CRCH)
Hex in:	(01)	(03)	(02)	(00)	(00)	(B8)	(44)

If the display format was sequence mode, you should receive**:**

	(IA)	(FN)	(count)	(1st value)	(Last Value)	(CRCL)	(CRCH)
Hex in:	(01)	(03)	(02)	(00)	(01)	(79)	(84)

WRITE EXAMPLES : ***In this write example we will configure INPUT 1 's Display Tag. The instrument's communication address is 4.***

Here is a partial listing of the Input registers:

Section 11: Inputs In this section, the group (n) is used to denote the input number and is from 1 to 8.

SS G RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
11 n 01	10	T	display tag	
11 n 11	1	C	input type/range	IV RANGE CODE-(see Appendix B for choices)
11 n 13	1	C	tc type	INPUT TC TYPES
11 n 14	1	C	rtd type	INPUT RTD TYPES
11 n 15	1	C	degrees c/f	INPUT TYPE C OR F
11 n 16	1	C	sensor break	IV SENSOR BREAK
11 n 31	2	F	input range low	
11 n 33	2	F	input range high	

Write Example # 1 :

This example will write "OVEN 1" to Input 1's DISPLAY TAG (register 11101),
refer to section 3.5 Write n Words Function 16.

	(IA)	(FN)	(Hi byte of 11101)	(Low byte of 11101)	(NWH)	(NWL)	(DATA)	(CRCL)	(CRCH)
Hex	(04)	(10)	(2B)	(5D)	(00)	(0A)	(see below)	(59)	(98)

04 = the instrument's Communication address
10 = the Modbus function(which is a 16 in ASCII)
2B = high byte of 11101 in Hex
67 = low byte of 11101 in Hex
00 = NWH in Hex (number of registers used = 10)
0A = NWL in Hex
59 = CRCL in Hex
98 = CRCH in Hex

Data sent = (14)("O")("V")("E")("N")(" ")("1")(" ")(" ")(" ")(" ")(" ")(" ")(" ")(" ")(" ")(" ")(" ")(" ")(" ")(" ")(" ")(" ")

Note: The 14 Hex at the front end indicates the number of data bytes being written to the 10 registers, which is 20 data bytes total.

Write Example 2:

In this write example we will configure INPUT 2's input type/range. The instrument's communication address is 4. INPUT 2's Input type/range (register 11211) will be set to 1 Volt. Note that for registers that have the **TYPE** = **C** (choice) you would need to see applicable choice values in **Appendix B.**

APPENDIX B (partial listing):

IV RANGE CODE Choice Values
0 off - no input
1 tc narrow
2 tc wide
3 rtd
4 mA
5 25mv
6 100mv
7 1 volt
8 10 volt
9 switch contact
11 communication input

Write Example # 2 :

The message sent to an instrument at address 4 to configure INPUT 2's input type/range for a 1 volt input is as follows:

	(IA)	(FN)	(PCH)	(PCL)	(VALUE HI)	(VALUE LO)	(CRCL)	(CRCH)
Hex out :	(04)	(06)	(2B)	(CB)	(00)	(07)	(B0)	(47)

04 = the instrument's Communication address
06 = the Modbus function - preset single register
2B = Parameter code high byte of 11211 in Hex
CB = Parameter code low byte of 11211 in Hex
00 = Value High in Hex
07 = Value low in Hex (the choice value for 1 volt)
B0 = CRCL in Hex
47 = CRCH in Hex

See Write 1 Word - Function Number 06.

The following read and write examples for actuators. Note that in Section 00 (Actuators) all are bit values, which are read as bits but written as a byte of 00 or FF.

Example 1 : Read the actuator value for Chart Rotation.

The message sent to "**read from"** the instrument at communication's address 2 would be as follows:

	(IA)	(FN)	(Hi byte of 00122)	(Low byte of 00122)	(NBH)	(NBL)	(CRCL)	(CRCH)
Hex out:	(02)	(01)	(00)	(7A)	(00)	(01)	(DC)	(20)

The response if the Chart rotation actuator is "0" :

	(IA)	(FN)	(COUNT)	(STATE)	(CRCL)	(CRCH)
Hex in:	(02)	(01)	(01)	(00)	(51)	(CC)

The response if the Chart rotation actuator is "1" :

	(IA)	(FN)	(COUNT)	(STATE)	(CRCL)	(CRCH)
Hex in:	(02)	(01)	(01)	(01)	(90)	(0C)

Example 2 : Write to the actuator value for Chart Rotation.

The message sent to **"write to"** to the instrument a value of **1** at communication's address 2 would be as follows:

	(IA)	(FN)	(PCH)	(PCL)	(State)	(0)	(CRCL)	(CRCH)
Hex out:	(02)	(05)	(00)	(7A)	(FF)	(00)	(AD)	(D0)

Note: For a "1" or **ON** state you would send a byte "**FF**" , for a "0" or **OFF** state you would send a "**00**" in the (State) position.

The instrument should respond by echoing the message in its entirety.

APPENDIX A - VERSACHART COMMUNICATIONS REGISTERS

Each VersaChart parameter or value described in the following tables is referred to in this document as an item. An item is referenced by specifying a register address, which is a decimal number from 0 to 65535 with the format SSGRR, where SS is the section number, G is the group within the section, and RR is the register number within the group. Group numbers are normally from 1 to 9, but when an address range requires more than 9 groups, it is implemented by incrementing the section and restarting the group at 0. For example, if section 42 required 15 groups, the addresses would range from 421RR to 429RR, followed by 430RR to 435RR, followed by 150RR to 152RR.

The '**SSGRR**' column normally specifies the register number of the item, but if the line refers to more than one item, the '**SSGRR**' column will specify the register numbers of the first and last item.

A register address represents data up to 2 bytes long. Thus items longer than 2 bytes require more than one register number to represent them. These numbers are always sequential, starting from the value in the '**SSGRR**' column, and the item is always referred to via the first number. The '**REG**' column specifies the number of register numbers per item.

NOTE: When using a third party **MMI** or **SCADA** software package please be aware that you may have to **offset** each of the SSGRR register address by adding **one**. This is because most packages are assuming that Modbus RTU is communicating to a PLC (Programmable Logic Controller) which uses **zero** as the first legitimate register assignment, while humans think of **one** as the first legitimate register address. Using Intellution's "The FIX" MMI software, the register assignments had to be offset by one. An example: To read the status of **ALARM 11** Actuator in Section 00 (register address 00101) , you must use 00102. To read **Input Value 1** (register 01101) you must use register 01102).

TYPE refers to the data type :
B = Digital bit values - one bit
I = Integer values - two byte integer in the range of -32,767 to +32,767
L = Long Values - four byte integer in the range of -2,147,483,647 to +2,147,483,647
T = ASCII Text - multiple byte ASCII text strings
F = Floating Point values - four byte floating point values in the range of +/- 1E-37 to +/- 1E+37
C = Choice - Please refer to the appropriate CHOICE table in Appendix B. All choice values are sent as an integers. The 'Applicable Choice Table/ Notes' column contains the choice table identifier.

In sections 00 and 01, the '**WRT** column specifies if the item can be written to (**y** = always, **s** = depending on system state). In sections other than 00 and 01, all other items can be written to unless otherwise specified.

Section numbers 9, 12, and those greater than 37 are reserved for future use.

Section 00 items are all bit values, which are read as bits and written as a byte of 00 or FF in Hex. See examples on page 20.

Section 01 items are all type **F** (4 byte floating point) except for timers and totals which are type **L** (4 byte long).

Section 00: Actuator Values : Section 00 items are all bit values, which are read as bits and written as a byte of 00 or FF. See example below.

SS G RR	REG	TYPE	WRT	ITEM DESCRIPTION	Applicable Choice Table/Notes
00 1 01	1	B		alarm 11	
00 1 02	1	B		alarm 12	
00 1 03	1	B		alarm 13	
00 1 04	1	B		alarm 14	
00 1 05	1	B		alarm 21	
00 1 06	1	B		alarm 22	
00 1 07	1	B		alarm 23	
00 1 08	1	B		alarm 24	
00 1 09	1	B		alarm 31	
00 1 10	1	B		alarm 32	
00 1 11	1	B		alarm 33	
00 1 12	1	B		alarm 34	
00 1 13	1	B		alarm 41	
00 1 14	1	B		alarm 42	
00 1 15	1	B		alarm 43	
00 1 16	1	B		alarm 44	
00 1 17	1	B		any alarm	
00 1 18	1	B		any process alarm	
00 1 19	1	B		instrument alarm	
00 1 20	1	B		chart full	
00 1 21	1	B		changing chart	
00 1 22	1	B	y	chart rotation	
00 1 23	1	B	y	trend data collect	
00 1 25	1	B		derived actuator 1	
00 1 26	1	B		derived actuator 2	
.					
.(same format for derived actuators 3 -23)					
.					
00 1 48	1	B		derived actuator 24	
00 1 49	1	B	y	operator input 1	
00 1 50	1	B	y	operator input 2	
.					
.(same format for operator inputs 3 -10)					
.					
00 1 59	1	B	y	operator input 11	
00 1 60	1	B	y	operator input 12	
00 1 61	1	B		preset 1	
00 1 62	1	B		preset 2	
00 1 63	1	B		preset 3	
00 1 64	1	B		preset 4	
00 1 65	1	B		total 1	
00 1 66	1	B		total 2	
00 1 67	1	B		total 3	
00 1 68	1	B		total 4	
00 1 69	1	B		switch 1	
00 1 70	1	B		switch 2	
00 1 71	1	B		switch 3	
00 1 72	1	B		switch 4	
00 1 73	1	B		switch 5	
00 1 74	1	B		switch 6	

Section 00: Actuator Values – Continued

SS G RR	REG	TYPE	WRT	ITEM DESCRIPTION	Applicable Choice Table/Notes
00 1 75	1	B		switch 7	
00 1 76	1	B		switch 8	
00 1 76	1	B		switch 8	
00 1 77	1	B		timer 1	
00 1 78	1	B		timer 2	
00 1 79	1	B		timer 3	
00 1 80	1	B		timer 4	
00 1 81	1	B		F1 key	
00 1 82	1	B		F2 key	
00 1 83	1	B		F3 key	
00 1 84	1	B		F4 key	
00 1 85	1	B		F5 key	
00 1 86	1	B		reset key	
00 1 87	1	B		mod key	
00 1 88	1	B		enter key	
00 1 89	1	B		time 1	
00 1 90	1	B		time / date 1	
00 1 91	1	B		time 2	
00 1 92	1	B		time / date 2	
00 1 93	1	B		time 1 to time 2	
00 1 94	1	B		time / date 1 to 2	
00 1 95	1	B		on the hour	
00 1 96	1	B		day of week	
00 1 97	1	B		day of month	
00 2 01	1	B		output 11	
00 2 02	1	B		output 12	
00 2 03	1	B		output 21	
00 2 04	1	B		output 22	
00 2 05	1	B		output 31	
00 2 06	1	B		output 32	
00 2 07	1	B		output 41	
00 2 08	1	B		output 42	
00 2 09	1	B	y	control access 1 F1	
00 2 10	1	B	y	control access 1 F2	
00 2 11	1	B	y	control access 1 F3	
00 2 12	1	B	y	control access 1 F4	
00 2 13	1	B	y	control access 1 F5	
00 2 14	1	B	y	control access 2 F1	
00 2 15	1	B	y	control access 2 F2	
00 2 16	1	B	y	control access 2 F3	
00 2 17	1	B	y	control access 2 F4	
00 2 18	1	B	y	control access 2 F5	
00 2 19	1	B	y	control access 3 F1	
00 2 20	1	B	y	control access 3 F2	
00 2 21	1	B	y	control access 3 F3	
00 2 22	1	B	y	control access 3 F4	
00 2 23	1	B	y	control access 3 F5	
00 2 24	1	B	y	control access 4 F1	
00 2 25	1	B	y	control access 4 F2	
00 2 26	1	B	y	control access 4 F3	
00 2 27	1	B	y	control access 4 F4	

Section 00: Actuator Values – Continued

SS	G	RR	REG	TYPE	WRT	ITEM DESCRIPTION	Applicable Choice Table/Notes
00	2	28	1	B	y	control access 4 F5	
00	2	29	1	B	y	comms trigger 1	
00	2	30	1	B	y	comms trigger 2	
00	2	31	1	B	y	comms trigger 3	
00	2	32	1	B	y	comms trigger 4	
00	2	33	1	B		relay 1	
00	2	34	1	B		relay 2	
00	2	35	1	B		relay 3	
00	2	36	1	B		relay 4	
00	2	37	1	B		relay 5	
00	2	38	1	B		relay 6	
00	2	39	1	B		relay 7	
00	2	40	1	B		relay 8	
00	2	41	1	B	y	events 1	
00	2	42	1	B	y	events 2	
00	2	43	1	B	y	events 3	
00	2	44	1	B	y	events 4	
00	2	45	1	B	y	events 5	
00	2	46	1	B	y	events 6	
00	2	47	1	B	y	events 7	
00	2	48	1	B	y	events 8	

Section 01: Real Time Values : Section 01 items are all type **F** (4 byte floating point) except for timers and totals which are type **L** (long 4 byte).

SS	G	RR	REG	TYPE	WRT	ITEM DESCRIPTION	Applicable Choice Table/Notes
01	1	01	2	F		input value 1	
01	1	03	2	F		input value 2	
01	1	05	2	F		input value 3	
01	1	07	2	F		input value 4	
01	1	09	2	F		input value 5	
01	1	11	2	F		input value 6	
01	1	13	2	F		input value 7	
01	1	15	2	F		input value 8	
01	2	01	2	F		process variable 1	
01	2	03	2	F		process variable 2	
01	2	05	2	F		process variable 3	
01	2	07	2	F		process variable 4	
01	3	01	2	F		derived variable 1	
01	3	03	2	F		derived variable 2	
.							
. (same format for derived variable 3-10)							
.							
01	3	21	2	F		derived variable 11	
01	3	23	2	F		derived variable 12	
01	4	01	2	L		total 1	
01	4	03	2	L		total 2	
01	4	05	2	L		total 3	
01	4	07	2	L		total 4	
01	5	01	2	L	y	timer 1	
01	5	03	2	L	y	timer 2	

Section 01: Real Time Values – Continued

SS	G	RR	REG	TYPE	WRT	ITEM DESCRIPTION	Applicable Choice Table/Notes
01	5	05	2	L	y	timer 3	
01	5	07	2	L	y	timer 4	
01	6	01	2	F	y	setpoint 1	
01	6	03	2	F	y	setpoint 2	
01	6	05	2	F	y	setpoint 3	
01	6	06	2	F	y	setpoint 4	
01	6	07	2	F	y	setpoint 5	
01	6	09	2	F	y	setpoint 6	
01	6	11	2	F	y	setpoint 7	
01	6	13	2	F	y	setpoint 8	
01	7	01	2	F	s	output 11	(only writable when in manual mode)
01	7	03	2	F	s	output 12	(only writable when in manual mode)
01	7	05	2	F	s	output 21	(only writable when in manual mode)
01	7	07	2	F	s	output 22	(only writable when in manual mode)
01	7	09	2	F	s	output 31	(only writable when in manual mode)
01	7	11	2	F	s	output 32	(only writable when in manual mode)
01	7	13	2	F	s	output 41	(only writable when in manual mode)
01	7	15	2	F	s	output 42	(only writable when in manual mode)
01	8	01	2	F	y	simulated value 1	
01	8	03	2	F	y	simulated value 2	
01	8	05	2	F	y	simulated value 3	
01	8	07	2	F	y	simulated value 4	

Most of the following registers will NOT be used if you are using a MMI program for communications. The most applicable are the Real Time Values in Section 01. The other registers are more for configuration. * Please see NOTE about MMI/SCADA software on page 19.

Section 02: Display

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
02	1	01	1	C	display mode	DISPLAY MODE
02	1	02	1	C	display format	DISPLAY STRATEGY
02	1	03	1	I	sequential display {duration}	

Section 02: Model & Revision

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
02	2	01	10	T	model number	
02	2	11	10	T	options	(Private label special parameter)
02	2	21	10	T	software revision	(read only)

Section 02: Enables & Passwords

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
02	3	01	1	C	change all enables to	DISABLE ENABLE
02	3	11	1	C	{enable} action time settings	DISABLE ENABLE
02	3	12	1	C	{enable} profile control	DISABLE ENABLE

Section 02: Enables & Passwords – Continued

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
02	3	13	1	C	{enable} profile entry	DISABLE ENABLE
02	3	14	1	C	{enable} profile continue	(not supported yet)
02	3	15	1	C	{enable} display log	(not supported yet)
02	3	16	1	C	{enable} alarm settings	DISABLE ENABLE
02	3	17	1	C	{enable} tuning parameters	DISABLE ENABLE
02	3	18	1	C	{enable} configuration	DISABLE ENABLE
02	3	19	1	C	{enable} derived actuators	DISABLE ENABLE
02	3	20	1	C	{enable} operator input configure	DISABLE ENABLE
02	3	21	1	C	{enable} operator messages	DISABLE ENABLE
02	3	22	1	C	{enable} chart messages	DISABLE ENABLE
02	3	23	1	C	{enable} simulated variables	DISABLE ENABLE
02	3	24	1	C	{enable} test	DISABLE ENABLE
02	3	25	1	C	{enable} calibration	DISABLE ENABLE
02	3	26	1	C	{enable} chart prompts	DISABLE ENABLE
02	3	27	1	C	{enable} chart configuration	DISABLE ENABLE
02	3	28	1	C	{enable} display prompts	DISABLE ENABLE
02	3	29	1	C	{enable} operator inputs	DISABLE ENABLE
02	3	30	1	C	{enable} setpoint changes	DISABLE ENABLE
02	3	31	1	C	{enable} control state access	DISABLE ENABLE
02	4	01	2	L	system prompts password	
02	4	11	2	L	enables & passwords password	
02	4	21	2	L	chart prompts password	
02	4	31	2	L	display prompts password	

Section 03: Action Time Settings

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
03	1	01	10	T	time 1 tag	
03	1	11	1	I	time 1 hour {for am/pm format}	
03	1	12	1	I	time 1 minute {for any format}	
03	1	13	1	C	time 1 am/pm select	AM/PM
03	1	14	1	I	time 1 hour {for 24 hour format}	
03	1	21	1	I	date 1 month {decimal format}	
03	1	22	1	I	date 1 day	
03	1	23	1	I	date 1 year	
03	1	24	1	C	date 1 month {text format}	MONTH LIST
03	1	31	10	T	time 2 tag	
03	1	41	1	I	time 2 hour {for am/pm format}	
03	1	42	1	I	time 2 minute {for any format}	
03	1	43	1	C	time 2 am/pm select	AM/PM
03	1	44	1	I	time 2 hour {for 24 hour format}	
03	1	51	1	I	date 2 month {decimal format}	
03	1	52	1	I	date 2 day	
03	1	53	1	I	date 2 year	
03	1	54	1	C	date 2 month {text format}	MONTH LIST
03	1	61	1	C	time display option	DISPLAY OPTION
03	1	62	1	C	day of week actuator	DAY SELECT
03	1	63	1	I	day of month actuator	

Section 04: Alarm Settings: In this section, group (n) is used to denote the PV number 1 to 4.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
04	n	01	2	F	alarm 1 setpoint	
04	n	03	2	F	alarm 2 setpoint	
04	n	05	2	F	alarm 3 setpoint	
04	n	07	2	F	alarm 4 setpoint	

Section 05: Tuning: In this section, the group (n) is used to denote the controller number , 1 to 4.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
03	1	63	1	I	day of month actuator	
05	n	01	2	F	setpoint ramp rate	
05	n	03	2	F	integration band	
05	n	05	2	F	integration shift	
05	n	11	2	F	output 1 proportional band	
05	n	13	2	F	output 1 shift	
05	n	15	2	F	output 1 auto reset	
05	n	17	2	F	output 1 rate	
05	n	21	2	F	output 2 proportional band	
05	n	23	2	F	output 2 shift	
05	n	25	2	F	output 2 auto reset	
05	n	27	2	F	output 2 rate	

Sections 06, 07: Constants In this section there are 12 Constants (CV1 - CV12). The group (G) is used to denote the constant number (1-12) and since groups can only be from 1 to 9 the Section or **SS = 06** is used to denote Constants CV1 through CV9, and **SS = 07** is used to denote CV10, CV11, and CV12**.**

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
06	1	01	2	F	whole number	(CV1)
06	1	03	2	F	exponent	(CV1 exponent portion)
06	2	01	2	F	whole number	(CV2)
06	2	03	2	F	exponent	(CV2 exponent portion)
.						
. (same format for CV3-CV8)						
.						
06	9	01	2	F	whole number	(CV9)
06	9	03	2	F	exponent	(CV9 exponent portion)
07	0	01	2	F	whole number	(CV10)
07	0	03	2	F	exponent	(CV10 exponent portion)
07	1	01	2	F	whole number	(CV11)
07	1	03	2	F	exponent	(CV11 exponent portion)
07	2	01	2	F	whole number	(CV12)
07	2	03	2	F	exponent	(CV12 exponent portion)

Section 08: Timers In this section, the group (n) is used to denote the timer number 1 to 4.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
08	n	01	10	T	display tag	
08	n	11	1	C	timer type	TIMER TYPE
08	n	12	1	C	time format	TIMER FORMAT
08	n	21	1	I	hours {for hhhmmss format}	
08	n	22	1	I	minutes {for hhhmmss format}	
08	n	23	1	I	seconds {for hhhmmss/mmmss format}	
08	n	24	1	I	minutes {for mmmss format}	

Section 08: Timers – Continue

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
08	n	25	1	I	seconds {for sss format}	
08	n	31	1	C	reset actuator	ACTUATOR
08	n	32	1	C	display option	DISPLAY OPTION

Section 10: Chart

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
10	1	01	1	C	chart rotation	OFF ON
10	1	02	1	C	trend data collect	OFF ON
10	1	03	1	C	chart speed	(not supported)
10	2	01	1	C	chart size	CHART SIZE
10	2	02	1	C	chart type used	CHART FORMAT
10	2	11	10	T	chart tag	
10	2	21	1	C	normal speed	CHART SPEED
10	2	22	1	I	normal speed other	
10	2	23	1	I	major time periods	
10	2	24	1	I	minor time periods	
10	2	25	1	I	blank major periods	
10	2	41	1	C	match major line pen/color	TIME LINE COLOR
10	2	42	1	C	major line pen/color	PEN COLOR NAME
10	2	43	1	C	match minor line pen/color	TIME LINE COLOR
10	2	44	1	C	minor line pen/color	PEN COLOR NAME
10	2	45	1	C	match time pen/color	(not supported)
10	2	46	1	C	time pen/color	PEN COLOR NAME
10	2	47	1	C	match date pen/color	(not supported)
10	2	48	1	C	date pen/color	PEN COLOR NAME
10	2	49	1	C	match chart tag pen/color	(not supported)
10	2	50	1	C	chart tag pen/color	PEN COLOR NAME
10	2	61	1	C	action on new chart	NEW CHART ACT
10	2	62	1	C	stop after 1 revolution	YES NO
10	2	71	1	C	rotate chart actuator	ACTUATOR
10	2	72	1	C	collect data actuator	ACTUATOR
10	2	81	1	C	chart rotation prompt {shown}	CHART PROMPT
10	2	82	1	C	trend data collect prompt {shown}	CHART PROMPT
10	2	83	1	C	chart speed prompt {shown}	CHART PROMPT

Section 11: Inputs

In this section, the group (n) is used to denote the input number 1 to 8.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
11	n	01	10	T	display tag	
11	n	11	1	C	input type/range	IV RANGE CODE
11	n	13	1	C	tc type	INPUT TC TYPES
11	n	14	1	C	rtd type	INPUT RTD TYPES
11	n	15	1	C	degrees c/f	INPUT TYPE C OR F
11	n	16	1	C	sensor break	IV SENSOR BREAK
11	n	31	2	F	input range low	
11	n	33	2	F	input range high	
11	n	35	2	L	pulse rate high	
11	n	37	1	I	communications address	
11	n	38	1	I	communications register	

Section 11: Inputs – Continued

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
11	n	39	1	C	communications data type	IV COMM TYPE
11	n	41	1	C	v/ma conversion	INPUT V/mA CONV
11	n	42	1	C	display units	UNIT TYPE
11	n	43	3	T	other units	
11	n	50	1	I	decimal position	
11	n	51	2	F	range limit low	
11	n	53	2	F	range limit high	
11	n	55	2	F	exponent	
11	n	61	1	C	cutoff type	CUTOFF TYPE
11	n	62	2	F	cutoff value	
11	n	71	2	F	input correct 1 {amount}	
11	n	73	2	F	input correct 1 at {value}	
11	n	75	2	F	input correct 2 {amount}	
11	n	77	2	F	input correct 2 at {value}	
11	n	79	1	I	value filter	
11	n	80	1	C	display option	DISPLAY OPTION
11	n	81	3	T	open/1 description	
11	n	86	3	T	closed/0 description	
11	n	91	1	I	display filter	

Section 13: Custom Curves

In this section, the group (n) is used to denote custom curve 1 to 4.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
13	n	01	1	I	decimal position of input	
13	n	02	1	I	decimal position of output	
13	n	03	1	I	number of points	
13	n	04	2	F	point pair 01 in	
13	n	06	2	F	point pair 01 out	
13	n	08	2	F	point pair 02 in	
13	n	10	2	F	point pair 02 out	
.						
.	(same format for Custom Curve points 3-19)					
.						
13	n	80	2	F	point pair 20 in	
13	n	82	2	F	point pair 20 out	
13	n	84	2	F	point pair 21 in	
13	n	86	2	F	point pair 21 out	

Sections 14, 15: Derived Variables

In this section there are 12 Derived Variables (DV1-DV12). The group (G) is used to denote the derived variable number (1-12) and since groups can only be from 1 to 9 the Section or **SS = 14** is used to denote DV1 through DV9, and **SS = 15** is used to denote DV10, DV11, and DV12. **Constants** in **Section 6, 7** show a detailed example of the format on page 25.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
14	n	01	10	T	display tag	(n =1 through 9 for DV1 -DV9)
15	0	01	10	T	display tag	(DV10 display tag)
15	1	01	10	T	display tag	(DV11 display tag)
15	2	01	10	T	display tag	(DV12 display tag)
14	n	11	1	C	function	DERIVED VARIABLE
14	n	21	1	C	input 1	INPUT SOURCE
14	n	22	1	C	input 2	INPUT SOURCE

Sections 14, 15: Derived Variables – Continued

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
14	n	23	1	C	input 3	INPUT SOURCE
14	n	24	1	C	input 4	INPUT SOURCE
14	n	25	1	C	input 5	INPUT SOURCE
14	n	31	1	C	actuator	ACTUATOR
14	n	32	1	C	reset actuator	ACTUATOR
14	n	33	1	C	track actuator	ACTUATOR
14	n	34	1	C	select b actuator	ACTUATOR
14	n	41	1	C	display units	UNIT TYPE
14	n	42	3	T	other units	
14	n	51	1	I	decimal position	
14	n	52	1	I	value filter	
14	n	53	1	C	display option	DISPLAY OPTION
14	n	54	1	I	display filter	

Section 16: Process Variables

In this section, the group (n) is used to denote the PV 1 to 4.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
16	n	01	10	T	display tag	
16	n	11	1	C	input	INPUT SOURCE
16	n	12	1	C	display units	UNIT TYPE
16	n	13	3	T	other units	
16	n	21	1	I	decimal position	
16	n	22	1	I	value filter	
16	n	23	1	C	display option	DISPLAY OPTION
16	n	24	1	I	display filter	
16	n	27	1	I	loop alarm time	
16	n	29	1	C	alarm inhibit	YES NO
16	n	31	1	I	alarm 1 type	
16	n	32	1	I	alarm 1 time	
16	n	33	1	I	alarm 1 rate period	
16	n	34	2	F	alarm 1 hysteresis	
16	n	41	1	I	alarm 2 type	
16	n	42	1	I	alarm 2 time	
16	n	43	1	I	alarm 2 rate period	
16	n	44	2	F	alarm 2 hysteresis	
16	n	51	1	I	alarm 3 type	
16	n	52	1	I	alarm 3 time	
16	n	53	1	I	alarm 3 rate period	
16	n	54	2	F	alarm 3 hysteresis	
16	n	61	1	I	alarm 4 type	
16	n	62	1	I	alarm 4 time	
16	n	63	1	I	alarm 4 rate period	
16	n	64	2	F	alarm 4 hysteresis	

Section 17: Recorders

In this section, the group is used to denote the recorder number 1 to 4.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
17	n	01	10	T	recorder tag	
17	n	11	1	C	value to record	INPUT SOURCE
17	n	12	1	C	pen color	PEN COLOR NAME
17	n	13	1	C	recording method	RECORD METHOD
17	n	14	1	I	decimal position	
17	n	15	1	I	chart divisions	
17	n	21	1	I	zone 1 low division	
17	n	22	1	I	zone 1 high division	
17	n	23	2	F	span 1 low value	
17	n	25	2	F	span 1 high value	
17	n	27	1	I	scale 1 interval	
17	n	31	1	I	zone 2 high division	
17	n	32	2	F	span 2 high value	
17	n	34	1	I	scale 2 interval	
17	n	51	1	I	position on error	
17	n	52	1	I	filter	

Section 18: Totalizers

In this section, the group is used to denote the totalizer number 1 to 4.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
18	n	01	10	T	display tag	
18	n	11	1	C	input value	INPUT SOURCE
18	n	12	1	C	time base	TOT TIME BASE
18	n	13	1	C	total is flow {times}	TOT FACTOR
18	n	14	3	T	display units	
18	n	21	1	I	decimal position	
18	n	22	1	C	display option	DISPLAY OPTION
18	n	23	1	C	display format	TOT FORMAT
18	n	24	1	C	totalizer type	TOT TYPE
18	n	31	2	F	totalizer preset	
18	n	33	2	F	low flow cutoff	
18	n	41	1	C	reset actuator	ACTUATOR
18	n	42	1	C	hold actuator	ACTUATOR
18	n	51	1	C	pulsed output	YES NO
18	n	52	2	F	pulse every {n units}	

Section 19: Controllers

In this section, the group is used to denote the controller number 1 to 4.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
19	n	01	1	C	control type	CONTROL TYPE
19	n	11	1	C	output 1 type	OUTPUT TYPE
19	n	12	2	F	output 1 hysteresis	
19	n	14	1	I	output 1 upper limit	
19	n	16	1	I	output 1 percent on error	
19	n	18	1	I	output slew rate	
19	n	21	1	C	output 2 type	OUTPUT TYPE
19	n	22	2	F	output 2 hysteresis	
19	n	24	1	I	output 2 upper limit	
19	n	26	1	I	output 2 percent on error	
19	n	31	1	C	manual actuator	ACTUATOR

Section 19: Controllers – Continued

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
19	n	32	1	C	auto m/a transfer	OFF ON
19	n	33	1	C	main setpoint source	INPUT SOURCE
19	n	34	1	C	remote setpoint actuator	ACTUATOR
19	n	35	1	C	remote setpoint source	INPUT SOURCE
19	n	36	1	C	second setpoint actuator	ACTUATOR
19	n	37	1	C	second setpoint source	INPUT SOURCE
19	n	41	2	F	setpoint ratio	
19	n	43	2	F	setpoint bias	
19	n	45	2	F	setpoint high	
19	n	47	2	F	setpoint low	
19	n	51	1	C	feedforward source	INPUT SOURCE
19	n	52	2	F	feedforward high	
19	n	54	2	F	feedforward low	
19	n	61	1	C	display selected setpoint	DISPLAY OPTION
19	n	62	1	C	display ramped setpoint	DISPLAY OPTION
19	n	63	1	C	display percent outputs	DISPLAY OPTION

Section 20: LEDs

In this section, the group is used to denote the LED number and is from 1 - 8.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
20	n	01	1	C	actuator	ACTUATOR

Section 21: Relays

In this section, the group is used to denote the relay number and is from 1-8.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
21	n	01	1	C	usage	RELAY USAGE
21	n	02	1	C	actuator	ACTUATOR
21	n	03	1	C	relay T.P. value	INPUT SOURCE
21	n	04	1	I	cycle time	

Section 22: Setpoints

In this section, the group is used to denote the controller number 1-4

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
22	n	01	10	T	prompt text	
22	n	11	1	C	display units	UNIT TYPE
22	n	12	3	T	other units	
22	n	21	1	I	decimal position	
22	n	25	2	F	upper limit	
22	n	27	2	F	lower limit	
22	n	31	1	C	display option	DISPLAY OPTION

Section 23: Current Outputs

In this section, the group is used to denote the current output 1 to 4.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
23	n	01	1	C	source	INPUT SOURCE
23	n	02	2	F	range low	
23	n	04	2	F	range high	
23	n	06	1	C	output range	CURRENT OUTPUT
23	n	07	1	I	output on error	

Section 25: Instrument Settings

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
25	1	01	10	T	instrument tag	
25	1	11	1	C	display option	DISPLAY OPTION
25	1	12	1	C	instrument on actuator	ACTUATOR
25	1	13	1	C	alarms on actuator	ACTUATOR
25	1	14	1	C	control on actuator	ACTUATOR
25	1	20	1	C	input scan sequence	SCAN SECQUENCE
25	1	21	1	C	date display format	DATE FORMAT
25	1	22	1	C	time display format	TIME FORMAT
25	1	31	1	I	month	
25	1	32	1	I	day	
25	1	33	1	I	year	
25	1	34	1	C	text month	MONTH LIST
25	1	40	1	C	current day	DAY SELECT
25	1	41	1	I	hour {AM / PM format only}	
25	1	42	1	I	minute	
25	1	43	1	C	am/pm select {AM / PM format only}	AM/PM
25	1	44	1	I	hour {24 Hr format only}	
25	1	51	1	C	communications mode	COMMS MODE
25	1	52	1	I	communications address	

Sections 26, 27, 28: Derived Actuators In this section there are 24 Derived Actuators (DA1-DA24). The group (G) is used to denote the DA (1-24) and since groups can only be from 1 to 9 the Section or **SS** = **26** is used to denote DA1 through DA9, **SS** = **27** is used to denote DA10-DA19, and **SS** = **28** is used to denote DA20-DA24. Each DA can have up to 24 items, and are selected by the **RR,** and using **Appendix B** for DA choice values.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
26	n	01	1	C	item 1	(n = 1 through 9 for DA1 - DA9)
26	n	02	1	C	item 2	(n = 1 through 9 for DA1 - DA9)
.						
. (same format for items 3-22)						
.						
26	n	23	1	C	item 23	(n = 1 through 9 for DA1 - DA9)
26	n	24	1	C	item 24	(n = 1 through 9 for DA1 - DA9)
27	n	01	1	C	item 1	(n = 0 through 9 for DA10 - DA19)
27	n	02	1	C	item 2	(n = 0 through 9 for DA10 - DA19)
.						
. (same format for items 3-22)						
.						
27	n	23	1	C	item 23	(n = 0 through 9 for DA10 - DA19)
27	n	24	1	C	item 24	(n = 0 through 9 for DA10 - DA19)
28	n	01	1	C	item 1	(n = 0 through 4 for DA20 - DA24)
.						
. (same format for items 2-22)						
.						
28	n	23	1	C	item 23	(n = 0 through 4 for DA20 - DA24)
28	n	24	1	C	item 24	(n = 0 through 4 for DA20 - DA24)

Sections 29, 30: Operator Inputs In this section there are 12 OI (OpIn1-OpIn12). The group (G) is used to denote the OI (1-12) and since groups can only be from 1 to 9 the Section or **SS = 29** is used to denote OI 1-9, and **SS = 30** is used to denote OI 10, OI 11, and OI 12.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
29	n	01	10	T	prompt text	(n = 1 - 9 for OpIn 1 - OpIn 9)
30	n	01	10	T	prompt text	(n = 0 - 2 for OpIn 10 - OpIn 12)
29	n	11	5	T	off/no/0 choice	
29	n	21	5	T	on/yes/1 choice	
29	n	31	1	C	actuation style	OP ACTION
29	n	32	1	C	power up state	OP PWR STATE
29	n	33	1	C	when displayed	OP IN ENABLE

Sections 31, 32: Operator Messages

In this section there are 12 OM (OM 1-OM 12). The group (G) is used to denote the OM (1-12) and since groups can only be from 1 to 9 the Section or **SS = 31** is used to denote OM 1-9, and **SS = 32** is used to denote OM10, OM11, and OM12.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
31	n	01	1	C	actuator for OM 1 - 9	ACTUATOR
32	n	01	1	C	actuator for OM 10-12	ACTUATOR
31	n	11	10	T	line 1 text	
31	n	21	10	T	line 2 text	
31	n	31	1	C	display mode	OM DP MODE

Sections 33, 34: Chart Messages

In this section there are 12 Chart Messages (Chart Mess 1-Chart Mess 12). The group (G) is used to denote the Chart Message number (1-12) and since groups can only be from 1 to 9 the Section or **SS = 33** is used to denote Chart Mess 1 through Chart Mess 9, and **SS = 34** is used to denote Chart Mess 10, Chart Mess 11, and Chart Mess 12.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
33	n	01	1	C	actuator (for chart mess 1 - 9)	ACTUATOR
34	n	01	1	C	actuator (for chart mess 10-12)	ACTUATOR
33	n	02	1	C	pen/color	PEN COLOR NAME
33	n	11	10	T	message text	
33	n	21	1	C	value 1	INPUT SOURCE
33	n	22	1	C	value 2	INPUT SOURCE
33	n	23	1	C	value 3	INPUT SOURCE
33	n	24	1	C	value 4	INPUT SOURCE
33	n	31	1	C	time/date stamp	YES NO
33	n	32	1	C	orientation	MSG ORIENT

Section 35: Simulated Variables In this section, the group is used to denote the SV 1 to 4.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
35	n	01	10	T	display tag	
35	n	11	1	C	type	SIM INPUT TYPE
35	n	12	1	C	units code	UNIT TYPE
35	n	13	3	T	other units	
35	n	21	1	I	decimal position	
35	n	22	2	F	range low	
35	n	24	2	F	range high	
35	n	26	1	I	period	
35	n	31	1	C	display option	DISPLAY OPTION

Section 36: Control State Access

In this section, the group is used to denote the CTRLSA 1 to 4.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
36	n	01	10	T	access line 1 text	
36	n	11	10	T	access line 2 text	
36	n	21	1	C	F1 key usage	F KEY USAGE
36	n	22	1	C	F2 key usage	F KEY USAGE
36	n	23	1	C	F3 key usage	F KEY USAGE
36	n	24	1	C	F4 key usage	F KEY USAGE
36	n	25	1	C	F5 key usage	F KEY USAGE
36	n	31	10	T	F1 key line 1 text	
36	n	41	10	T	F2 key line 1 text	
36	n	51	10	T	F3 key line 1 text	
36	n	61	10	T	F4 key line 1 text	
36	n	71	10	T	F5 key line 1 text	

Section 37: Custom State Access

In this section, the group is used to denote the CUSTSA 1 to 4.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
37	n	01	5	T	F1 line 2 text off	
37	n	06	5	T	F1 line 2 text on	
37	n	11	5	T	F2 line 2 text off	
37	n	16	5	T	F2 line 2 text on	
37	n	21	5	T	F3 line 2 text off	
37	n	26	5	T	F3 line 2 text on	
37	n	31	5	T	F4 line 2 text off	
37	n	36	5	T	F4 line 2 text on	
37	n	41	5	T	F5 line 2 text off	
37	n	46	5	T	F5 line 2 text on	

Sections 38, 39: Profile Entry

In this section there are 16 Profiles (Profiles 1-16). The group (G) is used to denote the Profile number (1-16) and since groups can only be from 1 to 9 the Section or **SS** = **38** is used to denote Profile 1-9, and **SS** = **39** is used to denote Profiles 10-16. Note the segments will be accessed in Section 41-56.

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
38	n	01	10	T	Profile Tag	
38	n	11	1	B	Number of setpoints	
38	n	12	1	B	Number of segments	
38	n	13	1	C	Guaranteed soak	YES/NO
38	n	14	2	F	Sp1 deviation up	
38	n	16	2	F	Sp1 deviation down	
38	n	18	2	F	Sp2 deviation up	
38	n	20	2	F	Sp2 deviation down	
38	n	22	2	F	Sp3 deviation up	
38	n	24	2	F	Sp3 deviation down	
38	n	26	2	F	Sp4 deviation up	
38	n	28	2	F	Sp4 deviation down	
38	n	30	1	B	Segment loop count	
38	n	31	1	C	When segment done	SEGMENT DONE
38	n	32	1	I	Profile loop count	
38	n	33	1	C	end action	END ACTION
38	n	34	1	C	abort action	ABORT ACTION

Sections 38, 39: Profile Entry

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
38	n	35	1	C	power fail action	PWR FAIL ACTION
38	n	36	1	B	recovery time limit hrs	
38	n	37	1	B	recovery time limit mins	
38	n	38	1	B	recovery time limit secs	
38	n	39	1	C	recovery action	RECOVERY ACTION

Sections 40: Profile Settings

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
40	n	01	1	C	Run Lock	PROF RUN LOCK
40	n	02	1	C	Start Actuator	ACTUATOR
40	n	03	1	C	Profile Selector	INPUT SOURCE
40	n	04	1	C	Abort Actuator	ACTUATOR
40	n	05	1	C	Hold Actuator	ACTUATOR
40	n	06	1	C	Advance Actuator	ACTUATOR
40	n	07	1	C	Display Option	DISPLAY OPTION

Sections 41: Profile 1 (Sections 42-56 for Profiles 2-16)

Section 41- 56 represent profiles 1-16. Only register designations for section 41 are shown below. Section 42 – 56 have the same register identifiers (RR). The group (G) is used to denote the segment number (1-8).

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
41	n	01	1	I	Ramp time hours segment n	
41	n	02	1	B	Ramp time minutes segment n	
41	n	03	1	B	Ramp time seconds segment n	
41	n	04	2	F	Setpoint one for segment n	
41	n	06	2	F	Setpoint two for segment n	
41	n	08	2	F	Setpoint three for segment n	
41	n	10	2	F	Setpoint four for segment n	
41	n	12	1	B	Ramp event 8 for segment n	
41	n	13	1	B	Ramp event 7 for segment n	
41	n	14	1	B	Ramp event 6 for segment n	
41	n	15	1	B	Ramp event 5 for segment n	
41	n	16	1	B	Ramp event 4 for segment n	
41	n	17	1	B	Ramp event 3 for segment n	
41	n	18	1	B	Ramp event 2 for segment n	
41	n	19	1	B	Ramp event 1 for segment n	
41	n	20	1	I	Dwell time hours segment n	
41	n	21	1	B	Dwell minutes segment n	
41	n	22	1	B	Dwell seconds segment n	
41	n	23	1	B	Dwell event 8 for segment n	
41	n	24	1	B	Dwell event 7 for segment n	
41	n	25	1	B	Dwell event 6 for segment n	
41	n	26	1	B	Dwell event 5 for segment n	
41	n	27	1	B	Dwell event 4 for segment n	
41	n	28	1	B	Dwell event 3 for segment n	
41	n	29	1	B	Dwell event 2 for segment n	
41	n	30	1	B	Dwell event 1 for segment n	

Sections 57: Profile Control

SS	G	RR	REG	TYPE	ITEM DESCRIPTION	Applicable Choice Table/Notes
57	1	01	1	C	Start Profile	START PROF
57	1	02	10	T	Start Description	
57	1	12	1	C	Profile Start Stop	PROF START/STOP
57	1	13	1	C	Profile Run Hold	PROF RUN/HOLD
57	1	14	1	B	Current Profile	
57	1	15	10	T	Current Description	
57	1	25	1	B	Current Segment	
57	1	26	1	I	Ramp Time Hours	
57	1	27	1	B	Ramp Time Minutes	
57	1	28	1	B	Ramp Time Seconds	
57	1	29	1	I	Dwell Time Hours	
57	1	30	1	B	Dwell Time Minutes	
57	1	31	1	B	Dwell Time Seconds	
57	1	32	1	B	Profile Event 1	
57	1	33	1	B	Profile Event 2	
57	1	34	1	B	Profile Event 3	
57	1	35	1	B	Profile Event 4	
57	1	36	1	B	Profile Event 5	
57	1	37	1	B	Profile Event 6	
57	1	38	1	B	Profile Event 7	
57	1	39	1	B	Profile Event 8	
57	1	40	1	C	Profile Status Action	PROF STAT ACT

APPENDIX B - VersaChart Communications Choice Values

These are the values to be sent to the instrument for the respective choices:

ABORT ACT	CHOICE VALUE
0	OFF, EVENTS OFF
1	OFF, EVENTS SAME
2	CONTROL, EVENTS SAME

ACTUATOR	CHOICE VALUE
0	NONE/OFF
1	ON/CONTINUOUS
12	ANY ALARM
13	ANY PROCESS ALARM
14	A11
15	A12
16	A13
17	A14
18	A21
19	A22
20	A23
21	A24
22	A31
23	A32
24	A33
25	A34
26	A41
27	A42
28	A43
29	A44
30	INSTRUMENT ALARM
31	CHART FULL
32	OP INP 1
33	OP INP 2
34	OP INP 3
35	OP INP 4
36	OP INP 5
37	OP INP 6
38	OP INP 7
39	OP INP 8
40	OP INP 9
41	OP INP 10
42	OP INP 11
43	OP INP 12
44	CHART CHANGED
45	CHART ROTATION
46	TREND DATA COLLECT
51	DA1
52	DA2
53	DA3
54	DA4
55	DA5
56	DA6
57	DA7

ACTUATOR	CHOICE VALUE
58	DA8
59	DA9
60	DA10
61	DA11
62	DA12
63	DA13
64	DA14
65	DA15
66	DA16
67	DA17
68	DA18
69	DA19
70	DA20
71	DA21
72	DA22
73	DA23
74	DA24
75	OUTPUT 11
76	OUTPUT 12
77	OUTPUT 21
78	OUTPUT 22
79	OUTPUT 31
80	OUTPUT 32
81	OUTPUT 41
82	OUTPUT 42
99	PRESET 1
100	PRESET 2
101	PRESET 3
102	PRESET 4
107	TOTAL PO1
108	TOTAL PO2
109	TOTAL PO3
110	TOTAL PO4
115	TIME 1
116	TIME/DATE 1
117	TIME 2
118	TIME/DATE 2
119	TIME 1 TO TIME 2
120	TIME/DATE 1 TO 2
121	TIMER 1
122	TIMER 2
123	TIMER 3
124	TIMER 4
129	SW1
130	SW2
131	SW3
132	SW4
133	SW5
134	SW6

ACTUATOR	CHOICE VALUE
135	SW7
136	SW8
145	COMM TRIGGER 1
146	COMM TRIGGER 2
147	COMM TRIGGER 3

148	COMM TRIGGER 4
149	F1
150	F2
151	F3
152	F4
153	F5
154	RESET
155	MOD
156	ENTER
162	ON THE HOUR
163	DAY OF WEEK
164	DAY OF MONTH
170	RELAY 1
171	RELAY 2
172	RELAY 3
173	RELAY 4
174	RELAY 5
175	RELAY 6
176	RELAY 7
177	RELAY 8
180	CA1F1
181	CA1F2
182	CA1F3
183	CA1F4
184	CA1F5
185	CA2F1
186	CA2F2
187	CA2F3
188	CA2F4
189	CA2F5
190	CA3F1
191	CA3F2
192	CA3F3
193	CA3F4
194	CA3F5
195	CA4F1
196	CA4F2
197	CA4F3
198	CA4F4
199	CA4F5
200	POWER FAILED
201	PROFILE ACTIVE
202	PROFILE COMPLETE
203	PROFILE ABORTED
204	PROFILE HOLDING
205	PROF AUTO HOLDING
206	PROF OFF/CONTROL

ALARM TYPE	**CHOICE VALUE**
0	OFF
1	PROCESS - HIGH
2	PROCESS - LOW
3	RATE - RISING
4	RATE - FALLING
5	BAND - WITHIN
6	BAND - OUTSIDE
7	DEVIATION - ABOVE
8	DEVIATION - BELOW
9	CONTROL LOOP OPEN

AM / PM	**CHOICE VALUE**
0	AM
1	PM

CHART FORMAT	**CHOICE VALUE**
0	RINGS/LINES/SCALES
1	RINGS AND TIMELINES
2	RINGS ONLY

CHART PROMPT	**CHOICE VALUES**
0	PROMPT NOT DISPLAYED
1	PROMPT DISPLAYED

CHART SIZE	**CHOICE VALUES**
0	10IN
1	11IN
2	12IN

CHART SPEED	**CHOICE VALUES**
0	8 HOURS
1	12 HOURS
2	24 HOURS
3	48 HOUR
4	7 DAY
5	OTHER

COMMS MODE	**CHOICE VALUES**
0	SLAVE
1	MASTER
2	OFF

CONTROL TYPE	**CHOICE VALUES**
0	STANDARD
1	CASCADE
2	FEEDFORWARD
3	SP + PID

CURRENT OUTPUT	**CHOICE VALUES**
0	0-20ma
1	4-20ma

CUTOFF TYPE	**CHOICE VALUES**
0	NONE
1	AT VALUE
2	TO ZERO BELOW VALUE
3	TO ZERO NEAR ZERO

DATE FORMAT	**CHOICE VALUES**
0	MM/DD/YY
1	DD/MM/YY
2	DD MMM YY

DAY SELECT	**CHOICE VALUES**
1	SUN
2	MON
3	TUE
4	WED
5	THURS

6	FRI
7	SAT

DERIVED ACT	CHOICE VALUES
0	END
1	OR
2	AND
3	NOT
4	(
5	)
12	ANY ALARM
13	ANY PROC ALARM
14	A11
15	A12
16	A13
17	A14
18	A21
19	A22
20	A23
21	A24
22	A31
23	A32
24	A33
25	A34
26	A41
27	A42
28	A43
29	A44
30	INSTRUMENT ALARM
31	CHART FULL
32	OP INP 1
33	OP INP 2
34	OP INP 3
35	OP INP 4
36	OP INP 5
37	OP INP 6
38	OP INP 7
39	OP INP 8
40	OP INP 9
41	OP INP 10
42	OP INP 11
43	OP INP 12
44	CHART CHANGED
45	CHART ROTATION
46	TREND DATA COLL
51	DA1
52	DA2
53	DA3

DERIVED ACT	CHOICE VALUES
54	DA4
55	DA5
56	DA6
57	DA7
58	DA8
59	DA9
60	DA10
61	DA11
62	DA12
63	DA13
64	DA14
65	DA15
66	DA16
67	DA17
68	DA18
69	DA19
70	DA20
71	DA21
72	DA22
73	DA23
74	DA24
75	OUTPUT 11
76	OUTPUT 12
77	OUTPUT 21
78	OUTPUT 22
79	OUTPUT 31
80	OUTPUT 32
81	OUTPUT 41
82	OUTPUT 42
99	PRESET 1
100	PRESET 2
101	PRESET 3
102	PRESET 4
107	TOTAL PO1
108	TOTAL PO2
109	TOTAL PO3
110	TOTAL PO4
115	TIME 1
116	TIME/DATE 1
117	TIME 2
118	TIME/DATE 2
119	TIME 1 TO TIME 2
120	TIME/DATE 1 TO 2
121	TIMER 1
122	TIMER 2
123	TIMER 3
124	TIMER 4
129	SW1
130	SW2
131	SW3
132	SW4
133	SW5
134	SW6
135	SW7
136	SW8
145	COMM TRIGGER 1
146	COMM TRIGGER 2
147	COMM TRIGGER 3
148	COMM TRIGGER 4

DERIVED ACT	CHOICE VALUES
149	F1
150	F2

151	F3
152	F4
153	F5
154	RESET
155	MOD
156	ENTER
162	ON THE HOUR
163	DAY OF WEEK
164	DAY OF MONTH
170	RELAY 1
171	RELAY 2
172	RELAY 3
173	RELAY 4
174	RELAY 5
175	RELAY 6
176	RELAY 7
177	RELAY 8
180	CA1F1
181	CA1F2
182	CA1F3
183	CA1F4
184	CA1F5
185	CA2F1
186	CA2F2
187	CA2F3
188	CA2F4
189	CA2F5
190	CA3F1
191	CA3F2
192	CA3F3
193	CA3F4
194	CA3F5
195	CA4F1
196	CA4F2
197	CA4F3
198	CA4F4
199	CA4F5
200	POWER FAILED
201	PROFILE ACTIVE
202	PROFILE COMPLETE
203	PROFILE ABORTED
204	PROFILE HOLDING
205	PROF AUTO HOLDING
206	PROF OFF/CONTROL

DERIVED VARIABLE	**CHOICE VALUES**
0	NONE
1	ADD
2	SUB
3	MUL
4	DIV
5	AVG
6	LIN
7	EXP
8	CONVERT F TO C
9	CONVERT C TO F
10	CUSTOM CURVE 1
11	CUSTOM CURVE 2
12	CUSTOM CURVE 3
13	CUSTOM CURVE 4
14	POLYNOMIAL
15	LINEAR MASS FLOW
16	DP MASS FLOW
17	BTU
18	RELATIVE HUMIDITY
19	F SUB O VALUE
20	ZRO2
21	LOG 10
22	LOG E
23	POWER 10
24	POWER E
25	HIGH SELECT
26	LOW SELECT
27	HIGH PEAK
28	LOW PEAK
29	TRACK AND HOLD
30	1 OF 2 SELECTOR
31	CONVERT ACTUATOR

DISABLE ENABLE	**CHOICE VALUES**
0	DISABLED
1	ENABLED

DISPLAY MODE	CHOICE VALUES
0	CONTINUOUS
1	SEQUENCE

DISPLAY OPTION	**CHOICE VALUES**
0	NOT DISPLAYED
1	IN CONTINUOUS MODE
2	IN SEQUENCIAL MODE
3	IN BOTH MODES

DISPLAY STRATEGY	**CHOICE VALUES**
0	1 VAL
1	2 VALS
2	4 PVs

END ACTION	**CHOICE VALUES**
0	OFF, EVENTS OFF
1	OFF, EVENTS SAME
2	CONTROL, EVENTS SAME

F KEY USAGE	**CHOICE VALUES**
0	NONE
1	C1 AUTO/MANUAL
2	C2 AUTO/MANUAL
3	C3 AUTO/MANUAL
4	C4 AUTO/MANUAL
5	LOCAL / REMOTE
6	SP1 / SP2
7	CUSTOM

INPUT_RTD_TYPES	CHOICE VALUES
0	PT 100 .00385 DIN
1	PT 100 .00392 USA
2	PT 100 .00392 SAMA
3	NI 100

INPUT SOURCE	CHOICE VALUES
0	NONE USED
1	IV1
2	IV2
3	IV3
4	IV4
5	IV5
6	IV6
7	IV7
8	IV8
9	PV1
10	PV2
11	PV3
12	PV4
13	DV1
14	DV2
15	DV3
16	DV4
17	DV5
18	DV6
19	DV7
20	DV8
21	DV9
22	DV10
23	DV11
24	DV12
25	CV1
26	CV2
27	CV3
28	CV4
29	CV5
30	CV6
31	CV7
32	CV8
33	CV9
34	CV10
35	CV11
36	CV12
37	TOTAL1
38	TOTAL2
39	TOTAL3
40	TOTAL4
41	SP1
42	SP2
43	SP3
44	SP4
45	SP5
46	SP6
47	SP7
48	SP8
49	OUTPUT 11
50	OUTPUT 12
51	OUTPUT 21
52	OUTPUT 22
53	OUTPUT 31
54	OUTPUT 32
55	OUTPUT 41
56	OUTPUT 42
89	SV1
90	SV2
91	SV3
92	SV4

INPUT TC TYPES	CHOICE VALUES
0	J
1	K
2	E
3	T
4	S
5	R
6	B
7	N
8	C
9	G
10	D
11	NI/NI-MOLY
12	PLATINEL II

INPUT TYPE C OR F	CHOICE VALUES
0	C
1	F

INPUT V/mA CONV	CHOICE VALUES
0	LINEAR
1	SQRT
2	EXP

IV_COMM TYPE	CHOICE VALUES
0	INT
1	LONG
2	FLOAT

IV_RANGE_CODE	CHOICE VALUES
0	OFF - NO INPUT
1	TC NARROW
2	TC WIDE
3	RTD
4	MA
5	25MV
6	100MV
7	1 VOLT
8	10 VOLT
9	SWITCH CONTACT
11	COMMS

IV_SENSOR BREAK	CHOICE VALUES
0	UPSCALE
1	DOWNSCALE

MONTH LIST	CHOICE VALUES
0	JAN
1	FEB
2	MAR
3	APR
4	MAY
5	JUN
6	JUL
7	AUG
8	SEP
9	OCT
10	NOV
11	DEC

MSG ORIENT	CHOICE VALUES
0	HORIZONTAL
1	VERTICAL

NEW CHART ACT	CHOICE VALUES
0	NONE-JUST CONTINUE
1	PRINT RANGE LIST
2	PRINT SCALES

OFF ON	CHOICE VALUES
0	OFF
1	ON

OM DP MODE	CHOICE VALUES
0	PREEMPT
1	PREEMPT TO CYCLIC
2	PREEMPT TO OFF
3	CYCLIC
4	BACKGROUND

OP ACTION	CHOICE VALUES
0	CONTINUOUS
1	MOMENTARY

OP PWR STATE	CHOICE VALUES
0	OFF
1	ON
2	SAME

OP IN ENABLE	CHOICE VALUES
0	ALWAYS
1	WHEN ENABLED

OUTPUT TYPE	CHOICE VALUES
0	NONE/OFF
1	ON/OFF DIRECT
2	ON/OFF REVERSE
3	PID DIRECT
4	PID REVERSE

PEN COLOR NAME	CHOICE VALUES
0	BLUE
1	GREEN
2	RED
3	BLACK
4	VIOLET

PROF RUN/HOLD	CHOICE VALUES
0	RUN
1	HOLD

PROF RUN LOCK	CHOICE VALUES
0	DISABLE DURING RUN
1	ENABLE DURING RUN

PROF START/STOP	CHOICE VALUES
0	ABORT/STOP
1	RUN/START

PROF STAT ACT	CHOICE VALUES
0	ABORTED
1	CONTINUE

PWR FAIL ACTION	CHOICE VALUES
0	CONTINUE
1	HOLD
2	ABORT
3	RESTART

RECORD METHOD	CHOICE VALUES
0	INSTANTANEOUS
1	CONNECT THE VAL
2	DRAG MIN TO MAX
3	AVERAGE
4	CONNECT THE AVG

RECOVERY ACTION	CHOICE VALUES
0	CONTINUE
1	HOLD
2	ABORT
3	RESTART

RELAY USAGE	CHOICE VALUES
0	STATE OR ON-OFF
1	PULSED OUTPUTS
2	TIME PROPORTIONING

SCAN SEQUENCE	CHOICE VALUES
0	8 IN-2 SCANS PER SEC
1	4 IN-4 SCANS PER SEC
2	2 IN-8 SCANS PER SEC
3	2 IN-4 S/S, 4 IN-2 S/S
4	1 IN-8 S/S, 2 IN-4 S/S
5	1 IN-8 S/S, 4 IN-2 S/S
6	2 IN-4, 2 IN-2, 4 IN-1 S/S
7	1 IN-8, 1 IN-4, 2 IN-2 S/S
8	1 IN-8 1 IN-4, 4 IN-1 S/S
9	1 IN-8, 2 IN-2, 4 IN-1 S/S
10	1 IN-8, 1 IN-2, 6 IN-1 S/S

SEGMENT DONE	CHOICE VALUES
0	OFF
1	JOIN 1
2	JOIN 2
3	JOIN 3
4	JOIN 4
5	JOIN 5
6	JOIN 6
7	JOIN 7
8	JOIN 8
9	JOIN 9
10	JOIN 10
11	JOIN 11
12	JOIN 12
13	JOIN 13
14	JOIN 14
15	JOIN 15
16	JOIN 16

SIM INPUT TYPE	CHOICE VALUES
0	OFF
1	SIN WAVE
2	SAWTOOTH
3	SQUARE WAVE
4	SPIKES

START PROF	CHOICE VALUES
0	CONTROL ON
1	PROF 1
2	PROF 2
3	PROF 3
4	PROF 4
5	PROF 5
6	PROF 6
7	PROF 7
8	PROF 8
9	PROF 9
10	PROF 10
11	PROF 11
12	PROF 12
13	PROF 13
14	PROF 14
15	PROF 15
16	PROF 16

TIME BASE	CHOICE VALUES
0	PER SEC
1	PER MIN
2	PER HOUR
3	PER DAY

TIME FORMAT	CHOICE VALUES
0	AM/PM
1	24 HOUR

TIME LINE COLOR	CHOICE VALUES
0	MATCH SCALE COLOR
1	SELECT A COLOR

TIMER FORMAT	CHOICE VALUES
0	SECONDS
1	MINS:SECS
2	HOURS:MINS:SEC

TIMER TYPE	CHOICE VALUES
0	OFF
1	COUNT UP
2	COUNT DOWN

TOT FACTOR	CHOICE VALUES
1	TIMES 1,000,000
2	TIMES 100,000
3	TIMES 10,000
4	TIMES 100
5	TIMES 10
6	TIMES 1
7	TIMES .1
8	TIMES .01
9	TIMES.001
10	TIMES .0001

TOT FORMAT	CHOICE VALUES
0	DIGITS - NO COMMAS
1	DIGITS - WITH COMMAS

TOT TIME BASE	
0	PER SEC
1	PER MIN
2	PER HOUR
3	PER DAY
4	PULSES

TOT TYPE	CHOICE VALUES
0	CONTINUOUS
1	PRELOAD
2	COUNT TO PRESET
3	COUNT DOWN PRESET

UNIT TYPE	CHOICE VALUES
0	C
1	F
2	OTHER

YES/NO	CHOICE VALUES
0	NO
1	YES