

PRODUCTION E340 COMMUNICATION LOGICAL MEMORY MAP

Revised July 3, 1995
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ALLEN-BRADLEY PROTOCOL

<u>COMMAND</u>	<u>CMD</u>	<u>PLC WORD ADDRESS LOW HIGH</u>	<u>DATA ADDRESS (octal)</u>	<u>LENGTH (BYTES)</u>
<u>UNPROTECTED BLOCK READ:</u>	01H	(see pages 5, 9 - 18)	format p. 7	
Time p.12, appendix A	p.12	00H,03H	600	6
Day of week	p.12	02H,03H	601	2
Device type and revision #	p.13	04H,03H	602	4
Sensor and digital inputs	p.14	06H,03H	603	16
Analog and relay outputs	p.15	08H,03H	604	12
Input used/unused status	p.16	0AH,03H	605	12
Modulator Feedback		0CH,03H	606	10
Exception Parameters	p.21	0EH,03H	607	26
Gas Pressure SetPoints	p.17	10H,03H	610	10
Oil Pressure SetPoints	p.17	12H,03H	611	10
Steam Pressure SetPoints	p.18	14H,03H	612	14
Water Temperature SetPoints	p.18	16H,03H	613	14
Oil Temperature SetPoints	p.17	18H,03H	614	10
Used Control SetPoints	p.19	1AH,03H	615	10
Thermal Shock SetPoints	p.20	1CH,03H	616	12
Used Variable	p.19	1EH,03H	617	22
Burner Statistics	p.22	20H,03H	620	6
Date	p.12	22H,03H	621	4
Mod Max Position Setting	p.20	24H,03H	622	2
SetBack Schedule	p.23	26H,03H	623	22
Daily Burner Minutes	p.22	28H,03H	624	48
Lag SetPoint Table	p.22	2AH,03H	625	14
Password	p.13	2CH,03H	626	2
Send Programmed on Schedule	p.24	2EH,03H	627	12
Send Gas Pressure Avg.	p.	30H,03H	630	16
Send Oil Pressure Avg.	p.	32H,03H	631	16
Send Stm Pressure Avg.	p.	34H,03H	632	16
Send Pri Temp. Avg.	p.	36H,03H	633	16
Send Aux Temp. Avg.	p.	38H,03H	634	16
Send Sensor Values with Command Rate	p.	3AH,03H	635	12
Send Last 10 Lockouts	p.	3CH,03H	636	22
Send Flag Registers	p.	3EH,03H	637	16
Send Sensor Values with Short Counters	p.	40H,03H	640	14

ALLEN-BRADLEY PROTOCOL (continued)

<u>COMMAND</u>	<u>CMD</u>	<u>PLC WORD</u>		<u>DATA</u>	<u>LENGTH</u> (BYTES)
		<u>ADDRESS</u>	<u>LOW HIGH</u>	<u>ADDRESS</u> (octal)	
<u>UNPROTECTED BLOCK WRITE:</u>	08H	(see pages 5, 19 - 34)		format p. 7	
Set the time	p.25	00H,03H		600	1
Set day of week	p.25	02H,03H		601	1
Lag steam set point	p.42	06H,03H		603	2
Lag water set point		08H,03H		604	2
Lag cut in, out, mbw		0AH,03H		605	3
Lag start delay		0CH,03H		606	1
Lead - lag delay		0EH,03H		607	1
Thermal shock start point	p.43	10H,03H		610	2
Thermal shock exit point		12H,03H		611	2
Thermal timed override		14H,03H		612	1
reserved for future use		10H,03H		610	0
Set Gas Pressure unused/used	p.26	1CH,03H		616	1
Set Oil Pressure unused/used		1EH,03H		617	1
Set Steam Press unused/used		20H,03H		620	1
Set Water Temp unused/used	p.27	22H,03H		621	1
Set Oil Temp unused/used		24H,03H		622	1
Set Modulator Feedback used		26H,03H		623	1
Set Thermal Shock unused/method		28H,03H		624	1
Set Aux AO2 used status	p.28	2AH,03H		625	1
Set Marginal Alarm used		2CH,03H		626	1
Set LEAD/LAG unused/used		2EH,03H		627	1
Set Setback unused/used		30H,03H		630	1
Set Program On used status	p.29	32H,03H		631	1
Set Lead Steam SetPoint		34H,03H		632	2
Set Lead Water SetPoint		36H,03H		633	2
Set Gas Pressure Limits		38H,03H		634	8
Set Oil Pressure Limits	p.30	3AH,03H		635	8
Set Steam Pressure Limits		3CH,03H		636	6
Set Water Temp Limits		3EH,03H		637	6
Set Oil temp Limits		40H,03H		640	6
Set Lead Steam Cut in	p.31	42H,03H		641	4
Set Lead Water Cut in		44H,03H		642	4
Set Date	p.25	46H,03H		643	1
Set Modulator Maximum	p.31	48H,03H		644	1
Set Lag Steam Setpoint	p.32	4AH,03H		645	1
Set Lag Water Setpoint		4CH,03H		646	1
Set Setback Steam Setpoint		4EH,03H		647	1
Set Setback Water Setpoint		50H,03H		650	1
Set Lag Cut in	p.33	52H,03H		651	2
Set Setback Cut in		54H,03H		652	2
Set Lag to Start Delay		56H,03H		653	1
Set Lead to Lag Delay		58H,03H		654	1

MODBUS PROTOCOL MEMORY MAP

<u>COMMAND</u>	<u>FNC</u>	<u>PLC WORD ADDRESS</u>		<u>DATA ADDRESS</u>	<u>LENGTH (BYTES)</u>
		<u>LOW</u>	<u>HIGH</u>		
<u>WORD READ:</u>	03H	(see pages 7 - 16)			
Time p.9, p. 36		00H	03H	600	6
Day of week		02H	03H	601	2
Device type and revision # p.10		04H	03H	602	4
Sensor and digital inputs p.14		06H	03H	603	16
Analog and relay outputs p.15		08H	03H	604	12
Input used/unused status p.16		0AH	03H	605	12
Modulator Feedback		0CH	03H	606	10
Exception Parameters p.13		0EH	03H	607	N/A
Gas Pressure SetPoints p.14		10H	03H	610	10
Oil Pressure SetPoints p.15		12H	03H	611	10
Steam Pressure SetPoints p.16		14H	03H	612	14
Water Temperature SetPoints p.17		16H	03H	613	14
Oil Temperature SetPoints p.18		18H	03H	614	10
Used Control SetPoints p.18		1AH	03H	615	10
Thermal Shock SetPoints p.19		1CH	03H	616	12
Used Variable		1EH	03H	617	22
Burner Statistics p.20		20H	03H	620	6
Date		22H	03H	621	4
Mod Max Position Setting		24H	03H	622	2
SetBack Schedule		26H	03H	623	22
Daily Burner Minutes		28H	03H	624	48
Lag SetPoint Table		2AH	03H	625	14
Password		2CH	03H	626	2
Send Gas Pressure Avg. p.		30H	03H	630	16
Send Oil Pressure Avg. p.		32H	03H	631	16
Send Stm Pressure Avg. p.		34H	03H	632	16
Send Pri Temp. Avg. p.		36H	03H	633	16
Send Aux Temp. Avg. p.		38H	03H	634	16
Send Sensor Values p.		3AH	03H	635	12
with Command Rate					
Send Last 10 Lockouts p.		3CH	03H	636	22
Send Flag Registers p.		3EH	03H	637	16
Send Sensor Values p.		40H	03H	640	14
with Short Counters					
Diagnostic Read		42H	03H	641	

MODBUS PROTOCOL MEMORY MAP (continued)

<u>COMMAND</u>	<u>FNC</u>	<u>PLC WORD ADDRESS</u> <u>LOW HIGH</u>	<u>DATA ADDRESS</u>	<u>LENGTH</u> <u>(BYTES)</u>
<u>WORD WRITE:</u>	06H	(see pages 7, 17 - 30)		
Set the time p.21		00H,03H	600	2
Set day of week		02H,03H	601	1
reserved for future use		10H,03H	610	0
Set Gas Pressure unused/used		1CH,03H	616	1
Set Oil Pressure unused/used		1EH,03H	617	1
Set Steam Press unused/used		20H,03H	620	1
Set Water Temp unused/used		62H,03H	621	1
Set Oil Temp unused/used		24H,03H	622	1
Set Modulator Feedback used		26H,03H	623	1
Set Thermal Shck unused/used		28H,03H	624	1
Set Aux AO2 used status		2AH,03H	625	1
Set Marginal Alarm unused/used		2CH,03H	626	1
Set LEAD/LAG unused/used		2EH,03H	627	1
Set Setback unused/used		30H,03H	630	1
Set Program On used status p.27		32H,03H	631	1
Set Lead Steam SetPoint p.27		34H,03H	632	2
Set Lead Water SetPoint p.28		36H,03H	633	2
Set Modulator Maximum		48H,03H	644	1
Set Lag Steam Setpoint p.32		4AH,03H	645	2
Set Lag Water Setpoint		4CH,03H	646	2
Set Setback Steam Setpoint		4EH,03H	647	2
Set Setback Water Setpoint		50H,03H	650	2
Set Lag to Start Delay		56H,03H	653	1
Set Lead to Lag Delay		58H,03H	654	1
Set Setback Override Hrs p.34		5AH,03H	655	1
Set Sunday Setback		5CH,03H	656	1
Set Monday Setback		5EH,03H	657	1
Set Tuesday Setback		60H,03H	660	1
Set Wednesday Setback		62H,03H	661	1
Set Thursday Setback		64H,03H	662	1
Set Friday Setback		66H,03H	663	1
Set Saturday Setback		68H,03H	664	1
Set End Setback Time		6AH,03H	665	2
Set Begin Setback Time		6CH,03H	666	2
Set Password		6EH,03H	667	2
Set Sunday Program on		70H,03H	670	1
Set Monday Program on		72H,03H	671	1
Set Tuesday Program on		74H,03H	672	1
Set Wednesday Program on		76H,03H	673	1
Set Thursday Program on		78H,03H	674	1
Set Friday Program on		7AH,03H	675	1
Set Saturday Program on		7CH,03H	676	1

MODBUS PROTOCOL MEMORY MAP (continued)

<u>COMMAND</u>	<u>FNC</u>	<u>PLC WORD ADDRESS</u> <u>LOW HIGH</u>	<u>DATA ADDRESS</u>	<u>LENGTH</u> <u>(BYTES)</u>
<u>WORD WRITE:</u> (continued)	06H	(see pages 7, 17 - 30)		
Set Begin Program on Time		7EH,03H	677	2
Set End Program on Time		80H,03H	700	2
Set Exception Parm's		82H,03H	702	
Disable Password Timer		84H,03H	701	
Set Lag Cut In		86H,03H	703	2
Set Lag Cut Out		88H,03H	704	
Set Lag Modulating Bandwidth		8AH,03H	705	
Set Steam Cut In		8CH,03H	706	
Set Steam Cut Out		8EH,03H	707	
Set Steam Modulating Bandwidth		90H,03H	710	
Set Steam Low Marginal Limit		92H,03H	711	
Set Steam High Marginal Limit		94H,03H	712	
Set Steam High Alarm Limit		96H,03H	713	
Set Primary Cut In		98H,03H	714	
Set Primary Cut Out		9AH,03H	715	
Set Primary Modulating Bandwidth		9CH,03H	716	
Set Primary Low Marginal Limit		9EH,03H	717	
Set Primary High Marginal Limit		A0H,03H	720	
Set Primary High Alarm Limit		A2H,03H	721	
Set Gas Low Alarm Limit		A4H,03H	722	
Set Gas Low Marginal Limit		A6H,03H	723	
Set Gas High Marginal Limit		A8H,03H	724	
Set Gas High Alarm Limit		AAH,03H	725	
Set Oil Low Alarm Limit		ACH,03H	726	
Set Oil Low Marginal Limit		AEH,03H	727	
Set Oil High Marginal Limit		B0H,03H	730	
Set Oil High Alarm Limit		B2H,03H	731	
Set Aux Low Alarm Limit		B4H,03H	732	
Set Aux Low Marginal Limit		B6H,03H	733	
Set Aux High Marginal Limit		B8H,03H	734	
Set Aux High Alarm Limit		BAH,03H	735	
Set SetBack Cut In		BCH,03H	736	2
Set SetBack Cut Out		BEH,03H	737	2
Set SetBack Modulating Range		C0H,03H	740	2
Diagnostic counter reset		C2H,03H	741	2

MODBUS PROTOCOL MEMORY MAP (continued)

<u>COMMAND</u>	<u>FNC</u>	<u>PLC WORD ADDRESS</u> <u>LOW HIGH</u>	<u>DATA ADDRESS</u>	<u>LENGTH</u> <u>(BYTES)</u>
<u>BLOCK WRITE:</u>	10H	(see pages 8, 31)		
Set counter	p.27	34H,03H	632	
Set timer	p.28	36H,03H	633	
Set PIDs	p.28 - 29	38H,03H	634	
Set Data Access Table	p.33	52H,03H	651	
Write Any Words		54H,03H	652	
Load program	p.31	70H,01H		

ALLEN BRADLEY MESSAGE STRUCTURE DESCRIPTION

UNPROTECTED BLOCK READ:

command format:

DLE 10H	SOH 01H	STN	DLE 10H	STX 02H	DST	SRC	CMD 01	STS 00	TNS	TNS	ADR Lo	ADR Hi	DAT	DLE 10H	ETX 03H	CRC Lo	CRC Hi
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DAT = number of bytes to be read.

reply format:

DLE 10H	STX 02H	DST	SRC	CMD 41H	STS X 0	TNS	TNS	DATA... DATA Lo/hi	DLE 10H	ETX 03H	CRC Lo	Crc Hi
------------	------------	-----	-----	------------	------------	-----	-----	-----------------------	------------	------------	-----------	-----------

STS = error status 00 ---> no error
 10 ---> bad command (CMD) or function (FNC)
 20 ---> bad address
 30 ---> invalid data
 40 ---> bad size

UNPROTECTED BLOCK WRITE:

command format:

DLE 10H	SOH 01H	STN	DLE 10H	STX 02H	DST	SRC	CMD 08	STS 00	TNS	TNS	ADR Lo	ADR Hi	DAT Lo/hi	DLE 10H	ETX 03H	CRC Lo	CRC Hi
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data is checked for validity

reply format:

DLE 10H	STX 02H	DST	SRC	CMD 48H	STS X 0	TNS	TNS	DLE 10H	ETX 03H	CRC Lo	CRC Hi
------------	------------	-----	-----	------------	------------	-----	-----	------------	------------	-----------	-----------

STS = error status 00 ---> no error
 10 ---> bad command (CMD) or function (FNC)
 20 ---> bad address
 30 ---> invalid data
 40 ---> bad size

REPORT BY EXCEPTION FROM RTU

command format:

DLE 10H	STX 02H	DST	SRC	CMD 28H	STS 00	TNS	TNS	DATA	DLE 10H	ETX 03H	CRC Lo	Crc Hi
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data = number of bytes to be read.

REPLY BY MASTER TO RTU'S REPORT BY EXCEPTION

DLE 10H	SOH 01H	STN	DLE 10H	STX 02H	DST	SRC	CMD 68H	STS 00	TNS	TNS	DLE 10H	ETX 03H	CRC Lo	CRC Hi
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DIAGNOSTIC LOOP:

command format:

DLE 10H	SOH 01H	STN	DLE 10H	STX 02H	DST	SRC	CMD 06	STS 00	TNS	TNS	FNC 00	DATA..	DLE 10H	ETX 03H	CRC Lo	CRC Hi
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reply format:

DLE 10H	STX 02H	DST	SRC	CMD 46H	STS X 0	TNS	TNS	SAME DATA .. Lo/hi	DLE 10H	ETX 03H	CRC Lo	CRC Hi
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x = error status 0 ---> no error
 1 ---> bad command (CMD) or function (FNC)
 2 ---> bad address
 3 ---> invalid data

DIAGNOSTIC READ:

command format:

DLE 10H	SOH 01H	STN	DLE 10H	STX 02H	DST	SRC	CMD 06	STS 00	TNS	TNS	FNC 01	DLE 10H	ETX 03H	CRC Lo	CRC Hi
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reply format: data is checked for validity

DLE 10H	STX 02H	DST	SRC	CMD 46H	STS X 0	TNS	TNS	DATA .. Lo/hi	DLE 10H	ETX 03H	CRC Lo	CRC Hi
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x = error status 0 ---> no error
 1 ---> bad command (CMD) or function (FNC)
 2 ---> bad address
 3 ---> invalid data

DIAGNOSTIC COUNTERS RESET:

command format:

DLE 10H	SOH 01H	STN	DLE 10H	STX 02H	DST	SRC	CMD 06	STS 00	TNS	TNS	FNC 07	DLE 10H	ETX 03H	CRC Lo	CRC Hi
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reply format:

DLE 10H	STX 02H	DST	SRC	CMD 46H	STS X 0	TNS	TNS	DLE 10H	ETX 03H	CRC Lo	CRC Hi
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x = error status 0 ---> no error
 1 ---> bad command (CMD) or function (FNC)
 2 ---> bad address

MODBUS PROTOCOL MESSAGE STRUCTURE

WORD READ:

command format: (as sent to the RTU)

DST	FNC 3	ADR Hi	ADR Lo-1	DAT hi	DAT Lo	CRC Lo	CRC Hi
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DAT = number of words to be read

normal response format: (as sent from the RTU)

DST	FNC 3	DBC	DATA ... Hi/lo	CRC Lo	CRC Hi
-----	----------	-----	-------------------	-----------	-----------

DBC = data byte count

WORD WRITE:

command format: (as sent to the RTU)

DST	FNC 6	ADR Hi	ADR Lo-1	DAT hi	DAT Lo	CRC Lo	CRC Hi
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normal response: (echo of the command coming from the RTU)

DST	FNC 6	ADR hi	ADR LO-1	ADR Hi	DAT Lo	CRC Lo	CRC Hi
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BLOCK WRITE:

Command format: (as transmitted to the RTU)

DST	FNC 10H	ADR Hi	ADR Lo-1	REGISTERS Hi/lo	DATA BYTES	DATA hi	DATA Lo	~ ~	~ ~	CRC Lo	CRC Hi
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ADR lo from Memory Map - 1 is transmitted

registers or quantity of words = integer ((number of bytes of data)/2)

hi registers = 0, # low registers = 1 - 60

note : The RTU calculates the CRC on the basis of the byte count, not the word count.

normal response format: (as sent from the RTU)

DST	FNC 10H	ADR Hi	ADR Lo-1	REGISTERS Hi/lo	CRC Lo	CRC Hi
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EXCEPTION RESPONSE:

command format:

DST	FNC	EXCEPT CODE	CRC Lo	CRC Hi
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Exception code = 1 Function code is illegal
 2 Address field is invalid
 3 Data field is invalid

FNC = return the function code with bit 7 set to indicate an exception message. (e.g. 83H, 86H, or 90H)

CA PROTOCOL MESSAGE STRUCTURE

Command structure for reads & writes

0FH	ADR	FNC	DAT1	DAT2	DAT3	CRC HI	CRC LO
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No Error Response structure for reads

F0H	ADR	FNC	DAT1 ms	DAT1 1s	~ ~	DATn ms	DATn 1s	00H	CRC HI	CRC LO
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Error Response structure: NO RESPONSE

No Error Response structure for writes

F0H	ADR	FNC	DAT1	DAT2	DAT3	CRC HI	CRC LO
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FORMAT OF VALUES

Pressure Sensors:

Each pressure sensor, regardless of range, outputs a value from 1 to 5 volts. This signal is then inputted to a 12 bit A/D converter so the span of each sensor is 0 to 4095 bits. This span is available from every read operation of a pressure sensor. If a pressure sensor is less than 1 volt then the A/D converter treats this as value of 0. Conversely if a pressure sensor is greater than 5 volts then the A/D converter treats this as a value of 4095.

The E340 firmware scales the sensor reading according the range selected. That is if the gas pressure sensor selected is 0-16 in wc then the E340 treats this as 256 bits per in wc. All other sensors are scaled according to the following table:

Gas Pressure

Sensor	Scale	Offset
0 - 16 in wc	256 bits/in wc	0
0 - 32 in wc	128 bits/in wc	0
0 - 160 in wc	25.6 bits/in wc	0
1 - 17 psi	256 bits/psi	1

Oil/Steam Pressure

Sensor	Scale	Offset
1 - 17 psi	256 bits/psi	1
1- 33 psi	128 bits/psi	1
10 - 170 psi	25.6 bits/psi	10
10 - 330 psi	12.8 bits/psi	10
50 - 850 psi		50

The pressure sensors are quite linear over their respective ranges.

The minimum allowable value that can be set for any pressure alarm point or set point is 256. Any value less than this will return an error.

The maximum allowable value that be set for any pressure alarm point or set point is 3840. Any value greater than this will return an error.

These values were selected to protect the E340 from shorted or open sensors.

The range of values for steam pressure or primary temperature cut out or modulating bandwidth is 3 to 60. However, for steam pressure sensors in the range of 1-17 psi of 1-33 psi this is interpreted as .3 to 6 psi. For pressure sensor values in the range of 10-170 psi, 10-330 psi, or 50-850 psi this is interpreted as 3 to 60 psi. This means the value written to the

E340 is in the range of 3 to 60. It is the E340 that translates the value into the appropriate bit value.

The allowable range of cut in value for steam pressure and primary temperature is 0 to 60. The value is interpreted the same as above in respect to sensor range.

For primary temperature sensor the value is 3 to 60 F if the value is conversion is English and 3 to 60 C if the conversion value is Centigrade.

If values are written that are out of order, that is the high water marginal is less than the low water marginal, then the result will be an alarm lockout by the E340. This means that the value will be accepted by the E340 but subsequent routines will force the alarm.

Temperature Sensors

The primary and auxiliary temperature sensors at this time have an acceptable operating range of 32F to 750F or 0C to 400C. This translates to respective bit values of 1024 to 3072. However the maximum allowable high temperature limit is 3040.

Thermal Shock

The thermal shock values are interpreted as steam pressure if Steam Pressure is the control variable and Primary Temperature is not selected as Standby Water. Otherwise the thermal shock values are interpreted as temperature values.

Lag Setpoints

The lag setpoints are always the same as the control variable regardless if Standby Water is selected.

READ THE TIME:

PLC word address (octal) = 600
Logical address = 000H,003H

returns 3 data words: word1, word2, word3

SHOWN FOR DF1 PROTOCOL
FORMAT IS HIGH BYTE / LOW BYTE FOR MODBUS

word 1: low byte: hh = hours bit 6 = 1 indicates pm
bit 6 = 0 indicates am
high byte: mm = minutes
hh and mm are BCD numbers

word 2: low byte: HH = hours military time 0 to 24
high byte: 0

word 3: low byte: MM = minutes
high byte: 0
HH and MM are hexadecimal numbers

examples for A-B protocol (low byte sent first)

09H,00H,09H,0,0,0	--> 9:00 am
01H,25H,01H,0,19H,0	--> 1:25 am
41H,25H,0DH,0,19H,0	--> 1:25 pm
51H,30H,17H,0,1EH,0	--> 11:30 pm

READ THE DAY OF THE WEEK:

PLC word address (octal) = 601
Logical address = 002H,003H

returns 1 data word: word1

word 1: low byte: dd is a number between 0 and 6
0 = SUNDAY 6 = SATURDAY
high byte: 0

READ THE DATE:

PLC word address (octal) = 621
Logical address = 022H,003H

returns 4 bytes: read real time date from E340 clock

d1 day of the month (1 - 31 BCD)
d2 month of the year (1 - 12 BCD)
d3 year of the century (0 - 99 BCD)
d4 padding byte (0FFH)

READ THE DEVICE TYPE AND REVISION NUMBER:

PLC word address (octal) = 602
Logical address = 004H,003H

returns 2 data words: word1, word2

word 1: low byte: device type

0 = HV100A (HVAC control)
1 = RTU5/1000
2 = E340
3 = RTU5/2000
4 =
5 = EPP

high byte: 0

word 2: low byte: minor revision number in hexadecimal
high byte: major revision number in hexadecimal

example for A-B protocol (low byte is sent first):

001H,0,02H,01H = the device is an RTU, version 1.2

READ PASSWORD: (unpublished)

PLC word address (octal) = 626
Logical address = 2CH,03H

Returns 2 bytes:

d1 Level 1 password
d2 Level 2 password

READ SENSOR VALUES AND SYSTEM STATUS:

PLC word address (octal) = 603
Logical address = 006H,003H

returns 16 bytes:

d1 - d2	GAS PRESSURE SENSOR
d3 - d4	OIL PRESSURE SENSOR
d5 - d6	STEAM PRESSURE SENSOR
d7 - d8	WATER TEMPERATURE SENSOR
d9 - d10	AUXILIARY TEMPERATURE SENSOR

Each analog input represents the count of the analog to digital converter as a 12 bit binary number. The high nibble of the high byte is not used. The display of "UNDR RNG" on the keypad display represents a count of 0. The display of "OVR RNG" represents a maximum count of 0FFFH.

d11 - d12	FIRING RATE POSITION
d13	OPERATING MODE
	0 = lead
	1 = lag
	2 = setback
	3 = forced setback
	4 = standby
	5 = programmed off
d14	SETBACK OVERRIDE STATUS
	0 = inactive
	1 = active
d15	FUEL SELECT STATUS
	0 = none
	1 = gas
	2 = oil
	3 = heavy oil
d16	FLAME SAFEGUARD VALVE STATUS
	0 = closed
	1 = open

READ ANALOG AND RELAY OUTPUTS:

PLC word address (octal) = 604
Logical address = 008H,003H

returns 12 bytes

d1 - d2 COMMAND RATE POSITON
d3 - d4 AUXILIARY ANALOG OUTPUT 2

Each analog output represents a count between 0 to 4095 (12 bit binary number). 0 will output 4 mA and 4095 will output 20mA. The high nibble of the high byte is always 0. The low nibble of the low byte is ignored for an 8 bit output.

d5 SAFETY CIRCUIT STATUS
0 = open
1 = closed

d6 OPERATING CONTROL STATUS
0 = open
1 = closed

d7 E340 ALARM STATUS
0 = off
1 = on
>1 = marginal

d8 AUXILIARY RELAY
0 = on
1 = off

d9 padding byte (0FFH)

d10 RELAY MODE STATUS
bit 0 = relay 1 mode bit (0 = latched 1 = pulsed)
bit 1 = " 2 " "
bit 2 = " 3 " "
bit 3 = " 4 " "

d11 RELAY ACTION STATUS
bit 0 = relay 1 action bit (0 = normal 1 = reversed)
bit 1 = " 2 " "
bit 2 = " 3 " "
bit 3 = " 4 " "

d12 RELAY DWELL TIME
relay dwell time increments (from 0 to 235)
number of 5 milli-second period added to the
100ms base time
100 ms < dwell time < 1275 ms

READ SENSOR INPUT USED/UNUSED STATUS:

PLC word address (octal) = 605
Logical address = 00AH,003H

returns 12 bytes

d1 GAS PRESSURE UNUSED/USED STATUS
 0 = unused
 1 = 0 - 16 in wc
 2 = 0 - 32 in wc
 3 = 0 - 160 in wc
 4 = 1 - 17 psig

d2 OIL PRESSURE UNUSED/USED STATUS
 0 = unused
 1 = 10 - 170 psig
 2 = 10 - 330 psig

d3 STEAM PRESURE UNUSED/USED STATUS
 0 = unused
 1 = 1 - 17 psig
 2 = 1 - 33 psig
 3 = 10 - 170 psig
 4 = 10 - 330 psig
 5 = 50 - 850 psig

d4 WATER TEMPERATURE UNUSED/USED STATUS
 0 = unused
 1 = used
 2 = standby
 3 = stack
 4 = outdoor

d5 AUXILIARY TEMPERATURE UNUSED/USED STATUS
 0 = unused
 1 = oil temperature
 2 = stack

d6 MODULATOR FEEDBACK UNUSED/USED STATUS

d7 THERMAL SHOCK UNUSED/USED STATUS

d8 AUXILIARY ANALOG OUTPUT UNUSED/USED STATUS
 0 = unused
 1 = gas presure
 2 = oil pressure
 3 = steam pressure
 4 = water temperature
 5 = auxiliary temperature

d9 MARINAL ALARM UNUSED/USED STATUS

d10 UNITS OF CONVERSION
 0 = English
 1 = Centigrade

d11 INPUT OPTO COUPLER STATUS
 bit 0 = reference coupler
 bit 1 = flame safeguard fuel valve
 bit 2 = gas select
 bit 3 = oil select
 bit 4 = heavy oil select
d12 padding byte (0FFH)

READ SENSOR INPUT ALARM SETPOINTS

GAS PRESSURE SETPOINTS:

PLC word address (octal) = 610
Logical address = 010H,003H

returns 10 bytes:

d1 unused/used status
d2 - d3 low limit alarm value
d4 - d5 low limit marginal value
d6 - d7 high limit marginal value
d8 - d9 high limit alarm value

OIL PRESSURE SETPOINTS:

PLC word address (octal) = 611
Logical address = 012H,003H

returns 10 bytes:

d1 unused/used status
d2 - d3 low limit alarm value
d4 - d5 low limit marginal value
d6 - d7 high limit marginal value
d8 - d9 high limit alarm value
d10 padding byte (0FFH)

AUXILIARY TEMPERATURE SETPOINTS:

PLC word address (octal) = 614
Logical address = 018H,003H

returns 10 bytes:

d1 unused/used status
d2 - d3 low limit alarm value
d4 - d5 low limit marginal value
d6 - d7 high limit marginal value
d8 - d9 high limit alarm value
d10 padding byte (0FFH)

SEND CONTROL VARIABLE SETPOINTS:

STEAM PRESSURE SETPOINTS:

PLC word address (octal) = 612

Logical address = 014H,003H

returns 14 bytes: send information on used control variable
(steam pressure or water temperature)

d1 unused/used status
d2 - d3 steam pressure set point
d4 steam pressure cut in value
d5 steam pressure cut out value
d6 steam pressure modulating range
d7 - d8 steam pressure low limit alarm
d9 - d10 steam pressure low limit marginal value
d11 - d12 steam pressure high limit marginal value
d13 - d14 steam pressure high limit alarm value

WATER TEMPERATURE SETPOINTS:

PLC word address (octal) = 613

Logical address = 016H,003H

returns 14 bytes: send information on used control variable
(steam pressure or water temperature)

d1 water temperature unused/used status
d2 - d3 water temperature set point
d4 water temperature cut in value
d5 water temperature cut out value
d6 water temperature modulating range
d7 - d8 water temperature low limit alarm
d9 - d10 water temperature low limit marginal value
d11 - d12 water temperature high limit marginal value
d13 - d14 water temperature high limit alarm value

USED CONTROL VARIABLE SETPOINTS:

PLC word address (octal) = 615
Logical address = 01AH,003H

returns 10 bytes:

d1 unused/used status
d2 - d3 used control variable set point
d4 used control variable cut in value
d5 used control variable cut out value
d6 used control variable modulating range
d7 - d8 used control variable sensor value
d9 - d10 command rate position

USED CONTROL VARIABLE SETPOINTS:

PLC word address (octal) = 617
Logical address = 01EH,003H

returns 22 bytes: send steam water usage and control variable
 setpoint. Also send command rate, op mode,
 relay status, fuel status

d1 steam pressure unused/used status
d2 water temperature unused/used status
d3 - d4 control variable setpoint (computed)
d5 - d6 control variable cut in value (computed)
d7 - d8 control variable cut out value (computed)
d9 - d10 control variable modulating range (computed)
d11 - d12 steam sensor value
d13 - d14 water temperature sensor value
d15 - d16 command rate position
d17 operating control status
d18 operating mode
d19 setback override status
d20 fuel select status
d21 flame safeguard fuel valve status
d22 padding byte (0FFH)

READ THERMAL SHOCK SETPOINTS:

PLC word address (octal) = 616
Logical address = 01CH,003H

returns 12 bytes:

d1 thermal shock unused/used status
 0 = unused
 1 = low fire
 2 = segment
d2 - d3 thermal shock start point
d4 - d5 thermal shock exit point
d6 thermal shock timed override
d7 - d8 thermal shock re-entry point
d9 - d10 thermal shock goal
d11 - d12 thermal shock segment

RATE/PULSE COUNT (DIGITAL INPUT 1):

PLC word address (octal) = 606
Logical address = 00CH,003H

returns 5 data words: word1, word2, word3, word4, word5

word 1: current rate value in counts per second
 low byte then high byte
word 2: low byte: pulse counter totalizer low byte
 high byte: pulse counter totalizer middle byte
word 3: low byte: pulse counter totalizer high byte
 high byte: 0
word 4: time elapsed during totalization in seconds
word 5: low byte: current percent ON time for digital input 2
 (This value is updated every second)
 high byte: 0

Each variable is a hex number.

READ MOD MAX POSITION SETTING:

PLC word address (octal) = 622
Logical address = 24H,03H

Returns 2 bytes: programmed maximum modulaor position

d1 Max motor low byte
d2 Max motor high byte

READ EXCEPTION PARAMETERS:

PLC word address (octal) = 607
Logical address = 0EH,03H

data length = 14 word (28 bytes)

returns 28 bytes: d1 ... d28

d1 = status byte & address
 Any value other than FFH indicates a destination
 address in the ALLEN-BRADLEY protocol
 FFH = turn off the report by exception
00H - 0FEH = turn on the report by exception
 -if it was already on none of the parameters
 are changed.
 -if the status was FFH, it will be changed
 to 0, a default value (10 seconds) will be
 used for the interval timer.

d2,d3 = destination's memory location (low byte, high byte)
d4 = minimum time interval between reports (default 10 sec)
d5 = bits 0 to 5 --> digital input mask:
 any bit set to 1 triggers a report if the bit
 value of the digital input is different from the
 bit value for the same bit position in byte d6

d6 = digital input pattern

d7,d8 = 12 bit upper limit for analog input 1 (low/high)
d9,d10 = 12 bit lower limit for analog input 1
d11,d12 = 12 bit upper limit for analog input 2
d13,d14 = 12 bit lower limit for analog input 2
d15,d16 = 12 bit upper limit for analog input 3
d17,d18 = 12 bit lower limit for analog input 3
d19,d20 = 12 bit upper limit for analog input 4
d21,d22 = 12 bit lower limit for analog input 4
d23,d24 = 12 bit upper limit for analog input 5
d25,d26 = 12 bit lower limit for analog input 5

d27 = "DST" destination field for exception reply
 through the report by exception.

d28 = bit 0 is set for data sharing
 bit 1 is set to suppress DLE EOT response

d29,d30 = rate in counts per second on dig input 1
d31,d36 = large count accumulator of the rate input
d37,d38 = low byte is current_percent_on_time of
 digital input 2 sampled 200 times per sec
 hi byte is unused

SEND LAG SETPOINTS:

PLC word address (octal) = 625
Logical address = 02AH,003H

returns 14 bytes:

d1 steam pressure unused/used status
d2 water temperature unused/used status
d3 lag unused/used status
d4 - d5 lag steam pressure set point
d6 - d7 lag water temperature set point
d8 lag cut in point
d9 lag cut out point
d10 lag modulating range
d11 lag to lead delay (minutes)
d12 lag to start delay (minutes)
d13 setback override hours
d14 padding byte (0FFH)

BURNER STATISTICS:

PLC word address (octal) = 620
Logical address = 20H,03H

Returns 6 bytes: Send cycles, burner hours, system hours

d1 - d2 burner cycles (low byte,high byte)
d3 - d4 burner hours
d5 - d6 system hours

READ DAILY BURNER MINUTES:

PLC word address (octal) = 624
Logical address = 28H,03H

Returns 48 bytes: today's burner on minutes (6 bytes)
 last weeks daily burner on minutes
 assumed setback minutes = lead minutes - lag minutes

d1 - d2 today's total burner on minutes
d3 - d4 today's lead minutes
d5 - d6 today's lag minutes
d7 - d12 (today - 1)'s burner on minutes (same format)
d13 - d19 (today - 2)'s burner on minutes (same format)
d19 - d24 (today - 3)'s burner on minutes (same format)
d25 - d30 (today - 4)'s burner on minutes (same format)
d31 - d36 (today - 5)'s burner on minutes (same format)

d37 - d42 (today - 6)'s burner on minutes (same format)
d43 - d48 (today - 7)'s burner on minutes (same format)

SEND SETBACK SCHEDULE:

PLC word address (octal) = 623
Logical address = 26H,03H

Returns 22 bytes: Send programmed setback schedule

d1 steam pressure unused/used status
d2 water temperature unused/used status
d3 set back unused/used status
 0 = unused
 1 = setback used
 2 = standby
d4 - d5 set back begin time
d6 - d7 set back end time
d8 - d9 set back steam pressure set point (low/high)
d10 - d11 set back water temperature set point (low/high)
d12 set back cut in point
d13 set back cut out point
d14 set back modulating range
d15 set back Sunday used status
 0 = all setback
 1 = no setback
 2 = schedule
d16 set back Monday used status
d17 set back Tuesday status
d18 set back Wednesday status
d19 set back Thursday status
d20 set back Friday status
d21 set back Saturday status
d22 (padding byte 0FFH)

SEND PROGRAMMED ON SCHEDULE:

PLC word address (octal) = 627
Logical address = 2EH,03H

Returns 12 bytes: Send programmed on schedule

d1 program on unused/used status
 0 = unused
 1 = operating control
 2 = auxiliary relay
d2 - d3 begin on time
d4 - d5 end on time
d6 program on Sunday used status
 0 = all off
 1 = all on
 2 = schedule
d7 program on Monday used status
d8 program on Tuesday status
d9 program on Wednesday status
d10 program on Thursday status
d11 program on Friday status
d12 program on Saturday status

SEND LAST 10 LOCKOUTS:

PLC word address (octal) = 636
Logical address = 3CH,03H

Returns 22 bytes: Send last 10 lockouts

D1 = padding byte (0FFH)
D2 = NUMBER OF LOCKOUTS
D3,D4 = most recent lockout group + message
D5,D6 = lockout number 2
D6,D7 = lockout number 3
D8,D9 = lockout number 4
D10,D11 = lockout number 5
D12,D22 = lockout number 6 - 10

BLOCK WRITES BEGIN HERE -----

NOTE: BLOCK WRITES ARE NOT VALID FOR MODBUS

SET THE TIME:

PLC word address (octal) = 600
Logical address = 00H,01H

data length = 1 word

Data bytes = mm, hh

mm and hh are BCD numbers
word 1: low byte: mm = minutes

high byte: hh = hours bit 6 = 1 indicates pm
bit 6 = 0 indicates am

examples for A-B protocol (low byte first):
low, high

00H,09H	-->	9:00 am
30H,12H	-->	12:30 am
25H,01H	-->	1:25 am
25H,41H	-->	1:25 pm
30H,51H	-->	11:30 pm

SET DAY OF WEEK:

PLC word address (octal) = 601
logical address = 02H,01H

data length = 1 word

data byte = word 1

word 1: low byte: a number between 0 and 6
0 = SUNDAY 6 = SATURDAY
high byte: always 0

SET THE DATE:

PLC word address (octal) = 643
Logical address = 46H,03H

data length = 3 bytes
d1 = day of the month (0 - 31)
d2 = month of the year (0 - 12)
d3 = year of the century (0 - 99)

SET INPUT SENSORS 1 THROUGH 5 USED/UNUSED STATUS:

GAS PRESSURE:

PLC word address (octal) = 616

logical address = 1CH,03H

data length = 1 byte

low byte: input status

0 = unused

1 = 0 - 16 in wc

2 = 0 - 32 in wc

3 = 0 - 160 in wc

4 = 1 - 17 psig

OIL PRESSURE:

PLC word address (octal) = 617

logical address = 1EH,03H

data length = 1 byte

low byte: input status

0 = unused

1 = 10 - 170 psig

2 = 10 - 330 psig

STEAM PRESSURE:

PLC word address (octal) = 620

logical address = 20H,03H

data length = 1 byte

low byte: input status

0 = unused

1 = 1 - 17 psig

2 = 1 - 33 psig

3 = 10 - 170 psig

4 = 10 - 330 psig

5 = 50 - 850 psig

SET INPUT SENSORS 1 THROUGH 5 USED/UNUSED STATUS: (cont)

WATER TEMPERATURE:

PLC word address (octal) = 621

logical address = 22H,03H

data length = 1 byte

low byte: input status

0 = unused

1 = used

2 = standby

3 = stack

4 = outdoor

AUXILIARY TEMPERATURE:

PLC word address (octal) = 622

logical address = 24H,03H

data length = 1 byte

low byte: input status

0 = unused

1 = oil temperature

2 = stack

SET SYSTEM INPUTS USED/UNUSED STATUS

MODULATOR FEEDBACK

PLC word address (octal) = 623

logical address = 26H,03H

data length = 1 byte

low byte: input status

0 = unused

1 = used

THERMAL SHOCK

PLC word address (octal) = 624

logical address = 28H,03H

data length = 1 byte

low byte: input status

0 = UNUSED

1 = LOW FIRE

2 = SEGMENT

SET SYSTEM INPUTS USED/UNUSED STATUS (cont)

AUXILIARY OUTPUT

PLC word address (octal) = 625

logical address = 2AH,03H

data length = 1 byte

low byte: input status

0 = unused

1 = gas pressure

2 = oil pressure

3 = steam pressure

4 = water temprature

5 = auxiliary temperature

MARGINAL ALARM

PLC word address (octal) = 626

logical address = 2CH,03H

data length = 1 byte

low byte: input status

0 = unused

1 = used)

LEAD / LAG

PLC word address (octal) = 627

logical address = 2EH,03H

data length = 1 byte (2 bytes)

low byte: input status

0 = unused

1 = used

NIGHT SETBACK

PLC word address (octal) = 630

logical address = 30H,03H

data length = 1 byte

low byte: input status

0 = unused

1 = used

SET SYSTEM INPUTS USED/UNUSED STATUS (cont)

PROGRAM OFF CONTROL

PLC word address (octal) = 631

logical address = 32H,03H

data length = 1 byte

low byte: input status
0 = unused
1 = operating control
2 = auxiliary relay

SET STEAM PRESSURE SETPOINT:

PLC word address (octal) = 632

logical address = 34H,03H

data length = 1 word (2 bytes)

high byte = low data

low byte = high data

SET WATER TEMPERATURE SETPOINT:

PLC word address (octal) = 633

logical address = 36H,03H

data length = 1 word (2 bytes)

high byte = low data

low byte = high data

SET GAS PRESSURE LIMITS:

PLC word address (octal) = 634

Logical address = 38H,03H

data length = 8 bytes ;program alarm and marginal limits

d1 - d2 low limit alarm point
d3 - d4 low limit marginal alarm
d5 - d6 high limit marginal alarm
d7 - d8 high limit alarm point

each byte pair is low byte / high byte order.

SET OIL PRESSURE LIMITS:

PLC word address (octal) = 635

Logical address = 3AH,03H

data length = 8 bytes ;program alarm and marginal limits

d1 - d2 low limit alarm point
d3 - d4 low limit marginal alarm
d5 - d6 high limit marginal alarm
d7 - d8 high limit alarm point

each byte pair is low byte / high byte order.

SET STEAM PRESSURE LIMITS:

PLC word address (octal) = 636

Logical address = 3CH,03H

data length = 6 bytes ;program alarm and marginal limits

d1 - d2 low limit marginal alarm
d3 - d4 high limit marginal alarm
d5 - d6 high limit alarm point

each byte pair is low byte / high byte order.

SET WATER TEMPERATURE LIMITS:

PLC word address (octal) = 637

Logical address = 3EH,03H

data length = 6 bytes ;program alarm and marginal limits

d1 - d2 low limit marginal alarm
d3 - d4 high limit marginal alarm
d5 - d6 high limit alarm point

each byte pair is low byte / high byte order.

SET AUX TEMPERATURE LIMITS:

PLC word address (octal) = 640

Logical address = 40H,03H

data length = 8 bytes ;program alarm and marginal limits

d1 - d2 low limit alarm point
d3 - d4 low limit marginal alarm
d5 - d6 high limit marginal alarm
d7 - d8 high limit alarm point

each byte pair is low byte / high byte order.

SET STEAM PRESSURE CUT IN, CUTOUT, MOD BANDWIDTH:

PLC word address (octal) = 641

Logical address = 42H,03H

data length = 3 bytes

d1 = steam pressure cut in (0 to 60)

d2 = steam pressure cut out (3 to 60)

d3 = steam pressure modulating range (3 to 60)

SET WATER TEMPERATURE CUT IN, CUTOUT, MOD BANDWIDTH:

PLC word address (octal) = 642

Logical address = 44H,03H

data length = 3 bytes

d1 = water temperature cut in

d2 = water temperature cut out

d3 = water temperature modulating range

SET MODULATOR MAXIMUM POSITION:

PLC word address (octal) = 644

Logical address = 48H,03H

data length = 1 word

data byte = word 1 (12 bit resolution)

word 1: ADC count (range 0 to 4095)

SET LAG STEAM PRESSURE SETPOINT:

PLC word address (octal) = 645
Logical address = 4AH,03H

data length = 1 word

data byte = word 1 (12 bit resolution)

word 1: ADC count (range 0 to 4095)

SET LAG WATER TEMPERATURE SETPOINT:

PLC word address (octal) = 646
Logical address = 4CH,03H

data length = 1 word

data byte = word 1 (12 bit resolution)

word 1: ADC count (range 0 to 4095)

SET SETBACK STEAM PRESSURE SETPOINT:

PLC word address (octal) = 647
Logical address = 4EH,03H

data length = 1 word

data byte = word 1 (12 bit resolution)

word 1: ADC count (range 0 to 4095)

SET SETBACK WATER TEMPERATURE SETPOINT:

PLC word address (octal) = 650
Logical address = 50H,03H

data length = 1 word

data byte = word 1 (12 bit resolution)

word 1: ADC count (range 0 to 4095)

SET LAG CUT IN, CUT OUT, MODULATING RANGE:

PLC word address (octal) = 651
logical address = 52H,03H

data length = 3 bytes

d1 = lag cut in
d2 = lag cut out
d3 = lag modulating range

SET SETBACK CUT IN, CUT OUT, MODULATING RANGE:

PLC word address (octal) = 652
logical address = 54H,03H

data length = 3 bytes

d1 = setback cut in
d2 = setback cut out
d3 = setback modulating range

SET LAG TO START DELAY:

PLC word address (octal) = 653
logical address = 56H,03H

data length = 1 byte

range = 0 - 15 minutes

SET LEAD TO LAG DELAY:

PLC word address (octal) = 654
logical address = 58H,03H

data length = 1 byte

range = 0 - 30 minutes

SET SETBACK OVERRIDE HOURS:

PLC word address (octal) = 655
logical address = 5AH,03H

data length = 1 byte

range = 1 - 8 hours

SET SUNDAY SETBACK TYPE:

PLC word address (octal) = 656
logical address = 5CH,03H

data length = 1 bytes
0 = all off
1 = no off
2 = schedule

SET MONDAY SETBACK TYPE:

PLC word address (octal) = 657
logical address = 5EH,03H

data length = 1 bytes
0 = all off
1 = no off
2 = schedule

SET TUESDAY SETBACK TYPE:

PLC word address (octal) = 660
logical address = 60H,03H

data length = 1 bytes
0 = all off
1 = no off
2 = schedule

SET WEDNESDAY SETBACK TYPE:

PLC word address (octal) = 661
logical address = 62H,03H

data length = 1 bytes
0 = all off
1 = no off
2 = schedule

SET THURSDAY SETBACK TYPE:

PLC word address (octal) = 662
logical address = 64H,03H

data length = 1 bytes
0 = all off
1 = no off
2 = schedule

SET FRIDAY SETBACK TYPE:

PLC word address (octal) = 663
logical address = 66H,03H

data length = 1 bytes
0 = all off
1 = no off
2 = schedule

SET SATURDAY SETBACK TYPE:

PLC word address (octal) = 664
logical address = 68H,03H

data length = 1 bytes
0 = all off
1 = no off
2 = schedule

SET END SETBACK TIME:

PLC word address (octal) = 665
logical address = 6AH,03H

data length = 2 bytes
d1 high byte of time
d2 low byte of time

SET BEGIN SETBACK TIME:

PLC word address (octal) = 666
logical address = 6EH,03H

data length = 2 bytes
d1 high byte of time
d2 low byte of time

SET PASSWORD:

PLC word address (octal) = 667
logical address = 6EH,03H

data length = 2 bytes
d1 level 1 of password
d2 level 2 of password

SET SUNDAY PROGRAM ON TYPE:

PLC word address (octal) = 670
logical address = 70H,03H

data length = 1 bytes
0 = all off
1 = all on
2 = schedule

SET MONDAY PROGRAM ON TYPE:

PLC word address (octal) = 671
logical address = 72H,03H

data length = 1 bytes
0 = all off
1 = all on
2 = schedule

SET TUESDAY PROGRAM ON TYPE:

PLC word address (octal) = 672
logical address = 74H,03H

data length = 1 bytes
0 = all off
1 = all on
2 = schedule

SET WEDNESDAY PROGRAM ON TYPE:

PLC word address (octal) = 673
logical address = 76H,03H

data length = 1 bytes
0 = all off
1 = all on
2 = schedule

SET THURSDAY PROGRAM ON TYPE:

PLC word address (octal) = 674
logical address = 78H,03H

data length = 1 bytes
0 = all off
1 = all on
2 = schedule

SET FRIDAY PROGRAM ON TYPE:

PLC word address (octal) = 675
logical address = 7AH,03H

data length = 1 bytes
0 = all off
1 = all on
2 = schedule

SET SATURDAY PROGRAM TYPE:

PLC word address (octal) = 676
logical address = 7CH,03H

data length = 1 bytes
0 = all off
1 = all on
2 = schedule

SET BEGIN PROGRAM ON TIME:

PLC word address (octal) = 677
logical address = 7E,03H

data length = 2 bytes
d1 high byte of time
d2 low byte of time

SET END PROGRAM ON TIME:

PLC word address (octal) = 700
logical address = 80H,03H

data length = 2 bytes
d1 high byte of time
d2 low byte of time

CANCEL PASSWORD:

PLC word address (octal) = 701
logical address = 82H,03H

this message is to disable the password enable before the user terminates the conversation. the E340 won't be left exposed while the time out handler is waiting.

data length = 1 byte
d1 = the number 2

SET LAG CUT IN:

PLC word address (octal) = 703
logical address = 86H,03H

data length = 2 bytes
d1 high byte of lag cut in
d2 low byte of lag cut in

SET LAG CUT OUT:

PLC word address (octal) = 704
logical address = 88H,03H

data length = 2 bytes
d1 high byte of lag cut out
d2 low byte of lag cut out

SET LAG MODULATING BAND WIDTH:

PLC word address (octal) = 705
logical address = 8AH,03H

data length = 2 bytes
d1 high byte of modulating bandwidth
d2 low byte of modulating bandwidth

SET STEAM CUT IN:

PLC word address (octal) = 706
logical address = 8CH,03H

data length = 2 bytes
d1 high byte of steam cut in
d2 low byte of steam cut in

SET STEAM CUT OUT

PLC word address (octal) = 707
logical address = 8EH,03H

data length = 2 bytes
d1 high byte of steam cut out
d2 low byte of steam cut out

SET STEAM MODULATING BANDWIDTH:

PLC word address (octal) = 710
logical address = 90H,03H

data length = 2 bytes
d1 high byte of steam modulating bandwidth
d2 low byte of steam modulating bandwidth

SET STEAM LOW ALARM MARGINAL:

PLC word address (octal) = 711
logical address = 92H,03H

data length = 2 bytes
d1 high byte of steam marginal low alarm limit
d2 low byte of steam marginal low alarm limit

SET STEAM HIGH ALARM MARGINAL:

PLC word address (octal) = 712
logical address = 94H,03H

data length = 2 bytes
d1 high byte of steam marginal high limit
d2 low byte of steam marginal high limit

SET STEAM HIGH ALARM LIMIT:

PLC word address (octal) = 713
logical address = 96H,03H

data length = 2 bytes
d1 high byte of steam high alarm limit
d2 low byte of steam high alarm limit

SET WATER CUT IN:

PLC word address (octal) = 714
logical address = 98H,03H

data length = 2 bytes
d1 high byte of water cut in
d2 low byte of water cut in

SET WATER CUT OUT

PLC word address (octal) = 715
logical address = 9AH,03H

data length = 2 bytes

d1 high byte of water cut out
d2 low byte of water cut out

SET WATER MODULATING BANDWIDTH:

PLC word address (octal) = 716
logical address = 9CH,03H

data length = 2 bytes
d1 high byte of water modulating bandwidth
d2 low byte of water modulating bandwidth

SET WATER LOW ALARM MARGINAL:

PLC word address (octal) = 717
logical address = 9EH,03H

data length = 2 bytes
d1 high byte of water marginal low alarm limit
d2 low byte of water marginal low alarm limit

SET WATER HIGH ALARM MARGINAL:

PLC word address (octal) = 720
logical address = A0H,03H

data length = 2 bytes
d1 high byte of water marginal high limit
d2 low byte of water marginal high limit

SET WATER HIGH ALARM LIMIT:

PLC word address (octal) = 721
logical address = A2H,03H

data length = 2 bytes
d1 high byte of water high alarm limit
d2 low byte of water high alarm limit

SET GAS PRESSURE LOW ALARM LIMIT:

PLC word address (octal) = 722
logical address = A4H,03H

data length = 2 bytes
d1 high byte of gas pressure low alarm limit
d2 low byte of gas pressure low high alarm limit

SET GAS PRESSURE LOW MARGINAL ALARM LIMIT:

PLC word address (octal) = 723
logical address = A6H,03H

data length = 2 bytes
d1 high byte of gas pressure marginal low alarm limit
d2 low byte of gas pressure marginal low alarm limit

SET GAS PRESSURE HIGH MARGINAL ALARM LIMIT:

PLC word address (octal) = 724
logical address = A8H,03H

data length = 2 bytes
d1 high byte of gas pressure marginal high alarm limit
d2 low byte of gas pressure marginal high alarm limit

SET GAS PRESSURE HIGH ALARM LIMIT:

PLC word address (octal) = 725
logical address = AAH,03H

data length = 2 bytes
d1 high byte of gas pressure high alarm limit
d2 low byte of gas pressure high alarm limit

SET Oil PRESSURE LOW LARM LIMIT:

PLC word address (octal) = 726
logical address = ACH,03H

data length = 2 bytes
d1 high byte of oil pressure low alarm limit
d2 low byte of oil pressure low high alarm limit

SET Oil PRESSURE LOW MARGINAL ALARM LIMIT:

PLC word address (octal) = 727
logical address = AEH,03H

data length = 2 bytes
d1 high byte of oil pressure marginal low alarm limit
d2 low byte of oil pressure marginal low alarm limit

SET Oil PRESSURE HIGH MARGINAL ALARM LIMIT:

PLC word address (octal) = 730
logical address = B0H,03H

data length = 2 bytes
d1 high byte of oil pressure marginal high alarm limit

d2 low byte of oil pressure marginal high alarm limit

SET Oil PRESSURE HIGH ALARM LIMIT:

PLC word address (octal) = 731
logical address = B2H,03H

data length = 2 bytes

d1 high byte of oil pressure high alarm limit
d2 low byte of oil pressure high alarm limit

SET AUX TEMPERATURE LOW LARM LIMIT:

PLC word address (octal) = 732
logical address = B4H,03H

data length = 2 bytes

d1 high byte of aux temperature low alarm limit
d2 low byte of aux temperature low high alarm limit

SET AUX TEMPERATURE LOW MARGINAL ALARM LIMIT:

PLC word address (octal) = 733
logical address = B6H,03H

data length = 2 bytes

d1 high byte of aux temperature marginal low alarm limit
d2 low byte of aux temperature marginal low alarm limit

SET AUX TEMPERATURE HIGH MARGINAL ALARM LIMIT:

PLC word address (octal) = 734
logical address = B8H,03H

data length = 2 bytes

d1 high byte of aux temperature marginal high alarm limit
d2 low byte of aux temperature marginal high alarm limit

SET AUX TEMPERATURE HIGH ALARM LIMIT:

PLC word address (octal) = 735
logical address = BAH,03H

data length = 2 bytes

d1 high byte of aux temperature high alarm limit
d2 low byte of aux temperature high alarm limit

SET SETBACK CUT IN:

PLC word address (octal) = 736

logical address = BCH,03H

data length = 2 bytes

d1 high byte of set back cut in

d2 low byte of set back cut in

SET SETBACK COUT OUT:

PLC word address (octal) = 737

logical address = BEH,03H

data length = 2 bytes

d1 high byte of set back cut out

d2 low byte of set back cut out

SET SETBACK MODULATING BANDWIDTH:

PLC word address (octal) = 740

logical address = COH,03H

data length = 2 bytes

d1 high byte of set back modulating band width

d2 low byte of set back modulating band width

DIAGNOSTIC COUNTER RESET:

PLC word address (octal) = 741

logical address = C2H,03H

USED IN MODBUS / FISHER ONLY
CLEAR ALL DIAGNOSTIC COUNTERS
SPECIAL ROUTINE

RESERVED ADDRESSES:

PLC word address (octal) = 256 through 267
logical address = 05CH,03H through 06EH,03H

These addresses are reserved for future use.
If a message is received with one of these address, the reply will return a status indicating "bad address" (code = 2).

SET EXCEPTION REPORT PARAMETERS:

PLC word address (octal) = 671
Logical address = 72H,03H

data length = 14 word (28 bytes)

28 data bytes: d1 ... d28

d1 = destination address byte
03H - 0FEH = turn on report by exception to specified address, a station number ("STN") in the ALLEN-BRADLEY protocol
FFH = turn off the report by exception
00H = turn on the report by exception to E500
-if it was already on none of the parameters are changed.
-if the status was FFH, it will be changed to 0, a default value (10 seconds) will be used for the interval timer.

d2,d3 = destination's memory location
d4 = minimum time interval between reports (default 10 sec)
d5 = bit 1 to 5 --> digital input mask, inputs 1 - 5
d6 = digital input pattern, same bit meaning as in d5
d7,d8 = 12 bit upper limit for analog input 1
d9,d10 = 12 bit lower limit for analog input 1
d11,d12 = 12 bit upper limit for analog input 2
d13,d14 = 12 bit lower limit for analog input 2
d15,d16 = 12 bit upper limit for analog input 3
d17,d18 = 12 bit lower limit for analog input 3
d19,d20 = 12 bit upper limit for analog input 4
d21,d22 = 12 bit lower limit for analog input 4
d23,d24 = 12 bit upper limit for analog input 5
d25,d26 = 12 bit lower limit for analog input 5
d27 = "DST" destination field for exception reply
d28 = bit 0 is reserved
bit 1 is set to suppress DLE EOT response when the unit is polled, see note 1,2.
bit 2 is set to cause reply with 22 bytes of

user parameters taken from N10:111 - 121
to replace bytes D3 - D24 shown in the
EXCEPTION REPORT MESSAGE FORMAT
bit 3 is set to cause one report per status
change in USER-FLAGS, SCAN_ERROR,
DIGITAL INPUT ERROR, OR ANALOG INPUT ERROR
bits 4 - 7 are reserved for use in specials.

Users should consult supplemental data
sheets for their version.

EXCEPTION REPORT MESSAGE FORMAT:

DLE 10H	STX 02H	DST	SRC	CMD 28	STS 00	TNS	TNS	ADR lo	ADR Hi	~ ~
------------	------------	-----	-----	-----------	-----------	-----	-----	-----------	-----------	--------

D1	D2 0	D3 through D12	D13	D14 0	DLE 10H	ETX 03H	CRC Lo	Crc Hi
----	---------	----------------	-----	----------	------------	------------	-----------	-----------

STN = DST = defined in the first status parameter byte
D1 = bit 7 - error flag is on
bit 6 - digital input error
bit 5 - analog input is short or open
bit 4 - analog input limit error
bit 3 - first time error report
bit 2 - scan error non-recoverable
bit 1 - 1 or more USER_FLAGS set
bit 0 - reserved for indicating:
contains analog & digital
data which may be sent to other RTUs.

D2 = user_err status byte

```

-----
D3 through d12 = analog inputs      | report with bit 2
D13,D14         = digital inputs    | of D28 cleared
D15-D24         = report_count      | in SET EXCEPTION REPORT
-----

```

```

-----
D3 through D24 from N10:111 - 121 | report with bit 2
                                   | of D28 set
                                   | in SET EXCEPTION REPORT
-----

```

The analog and digital inputs follow the same format as in the "READ ANALOG AND DIGITAL INPUTS" message previously described (address 203 Octal 06H,03H Hex)

The reported count information follows the same format as the "RATE/PULSE_COUNT" message.

This error message has to be acknowledged by the master which also sends a reply indicating a good reception.

NOTE: the condition which causes a report by exception, causes repetitive reports by exception until the condition is removed unless d28 bit 3 is set to cause one report per status change in USER-FLAGS 1st byte, SCAN_ERROR 1st byte, DIGITAL INPUT ERROR, OR ANALOG INPUT ERROR

LAG SET POINT VARIABLES

LAG STEAM SET POINT

PLC word address (octal) = 603
logical address = 06H,03H

data length = 2 bytes

LAG WATER SET POINT

PLC word address (octal) = 604
logical address = 08H,03H

data length = 2 bytes

LAG CUT IN, CUT OUT , MOD BANDWIDTH

PLC word address (octal) = 605
logical address = 0AH,03H

data length = 3 bytes

d1 - lag cut in
d2 - lag cut out
d3 - modulating range

LAG START DELAY

PLC word address (octal) = 606
logical address = 0CH,03H

data length = 1 byte

range = 0 to 15 minutes

LEAD TO LAG DELAY

PLC word address (octal) = 607
logical address = 0EH,03H

data length = 1 byte

range = 0 to 15 minutes

THERMAL SHOCK VARIABLES

THERMAL SHOCK START POINT

PLC word address (octal) = 608
logical address = 10H,03H

data length = 2 bytes
range is same as selected control variable except
if water is standby then thermal shock is water

THERMAL SHOCK EXIT POINT

PLC word address (octal) = 609
logical address = 12H,03H

data length = 2 bytes
range is same as selected control variable except
if water is standby then thermal shock is water

THERMAL SHOCK TIMED OVERRIDE

PLC word address (octal) = 610
logical address = 14H,03H

data length = 1 byte
range = 1 to 60 minutes

DIAGNOSTIC LOOP:

Command 06H Function 0

the data is returned exactly as received when polled.

In MODBUS protocol the command message is returned exactly as received immediately upon reception.

DIAGNOSTIC STATUS:

Command 06H Function 3

data length 10 words

byte 1 = Operating mode
 - 1 = normal run mode
 - 2 = test force run mode
 - 3 = program mode
 - 4 = test force single scan mode
 - 5 = force run mode
byte 2 = Type of station interface module
byte 3,4 = reserved for the expansion of the station type
byte 5 = amount of external RAM
 - 2H = 2 K bytes
 - 32H = 32 K bytes
byte 6,7,8 = reserved for future use
 byte 9..16 = unit name in ASCII character eg "1710-PM3"
byte 17..20 = revision number in ASCII e.g. "3.B"
byte 21..28 = program name in ASCII e.g. "TANK 38"

DIAGNOSTIC COUNTER RESET:

Command 06H Function 7

Clear all diagnostic counters.

DIAGNOSTIC READ

Command 06H Function 1

data length = 13 words

each counter is a 16 bit binary number.

A-B	WORD #		
x	1	overflow	= receive buffer full
x	1	bad BCC or CRC	= number of message received with bad check character
x	1	communication error	= receiver not in initial state when receiving a new message
x	1	communication	= number of message received with good CRC
x	1	sink full	= received a new command before sending previous reply
x	1	trans. retried once	= number of reply sent 2 times
x	1	trans. retried twice	= number of reply sent 3 times
x	1	number of command messages received with data out of range	
x	1	number of command messages received with invalid size field	
x	1	reserved for future use	
x	1	number of command messages received with invalid CMD or FNC	
x	1	number of command messages received with invalid address	
x	1	low byte: analog input error	
		bit 0 through 2	= number of used analog inputs indicating "UNDER RNG" on the display at the time this diagnostic read command was received
		bits 3 - 7	= unused
x	1	high byte: padding byte	always 0

APPENDIX A

DATA FORMAT FOR TIME:

The high byte represents the hours.
the low byte represents the minutes.

Hours and minutes have a BCD representation (Binary Coded Decimal)
Bit 6 in the hour byte indicates AM/PM (0 = am, 1 = pm).

	HI	LOW	
	---	---	
examples: 12H,15H			--> 12:15 am (after midnight)
01H,25H			--> 1:25 am
09H,00H			--> 9:00 am
11H,59H			--> 11:59 am (before noon)
52H,30H			--> 12:30 pm (after noon)
41H,25H			--> 1:25 pm
51H,59H			--> 11:59 pm (before midnight)