WESCHLER INSTRUMENTS
DIVISION OF HUGHES CORP.

Advantage CT
Protocol Manual

Manual Part Number PMG4T200

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Firmware Covered by this Manual

G4TSYS0202 (with DNP-3 Communications)
G4TSYS0302 (without DNP-3 Communications)

1.0 Introduction

The Advantage CT is a dual protocol device. When equipped with digital communications, it can communicate using two different protocols simultaneously. The Simple ASCII Protocol (SAP), which is a Weschler proprietary communications specification is used by the Weschler configuration and monitoring programs, and may be incorporated into simple substation monitoring schemes where the more complex international protocols are not implemented.

The second protocol type must be specified at the time of ordering. Currently the DNP-3 Level 1 Slave implementation is provided. The protocol translator used in the Advantage is capable of having other protocols installed. A licensing fee may be required to provide the protocol depending upon the quantity of devices ordered. Consult Weschler Marketing at 440-238-2550 for further details. The protocol is installed by a simple firmware upgrade process, performed through digital communications. No hardware changes are required.

2.0 Simple ASCII Protocol (SAP)

All characters except the checksum are transmitted as 8-bit ACSII, with 1 start bit and 1 stop bit. All frames open with the start-of-command (SOC) character and close with the end-of-command (EOC) character, and the frame elements are comma delimited. Numeric data items are represented as ASCII encoded decimal numbers. Where a byte is used bitwise, the bit pattern will be converted to a decimal equivalent value from 0 to 255 prior to transmission.

Host Query Commands comprise three fields, the header field, Op Code field and trailer field. The header contains the SOC character, Unit ID and Command prefix. The Op Code field defines the type of query and which data group information is being requested from. The trailer field contains the checksum and EOC character.

Command and Reply frames are also arranged into three fields; the header field, data item field and trailer field. The header field contains the SOC, command or reply prefixes and Group ID Code. The data item field returns measurement and status information in response to host queries, or carries configuration settings from the host to the Advantage. The trailer field contains the checksum and EOC character.

The unit ID is used to identify individual Advantage units on a common communications path with other units. The unit ID can have values of 00 to 99 which allows for up to 100 units on a common path. Note that the RS-485 specification only allows up to 32 units on one buffered pair of conductors. As a consequence several buffered branches will be needed in order to use all available unit ID's.

When a radix is used, it will generally be assumed to occupy the position immediately to the left of the least significant digit (LSD), even though the actual radix is not transmitted. For example; the temperature 41.2 degrees will be transmitted as 412. The host software will need to replace the radix in its correct position when it receives the raw number. In some cases the radix will occupy 2 positions to the left of the LSD. These exceptions are shown in the "Range and Significance" columns of the tables.

Negative signs will be represented by ASCII code 2D hex, and will take the frame position immediately preceding the most significant digit. The maximum range of most numeric values will thus be -99.9 to 999.9. In practice this full range cannot be used due to limitations of transformer operating ranges. For load current indication, since the radix is not used, the value may range up to 99999 amps. Leading zeroes will only be used in the unit ID, and the frame length will therefore vary as a function of variable magnitude.

In all frames the checksum is the full (hex) sum of all character's ASCII codes from the SOC, up to and including the separator immediately preceding the checksum. The checksum is not converted to ASCII; it is transmitted as a hex value.

2.1 Host Query Commands

The query command consists of 5 parts; the SOC character, the unit ID, the command prefix, the Op Code and the EOC character.

In this specification, there are seven Op Codes, QDDA through QDDG. Op Code QDDA is reserved for future implementations. Op Codes QDDB through QDDI cause the Advantage to send digital data corresponding to the 7 defined information groups which are detailed in section 2.2. The following is an example of the host query command for Op Code QDDB, which requests measurement data :

Frame Representation>	:	0	0	Q	D	D	B	,	01	E1	,	CR
	SOC Character	Unit ID Char 1	Unit ID Char. 2	Command Prefix	Op Code Char 1	Op Code Char 2	Op Code Char 3	Separator Char	Checksum Hi Byte	Checksum Lo Byte	Separator Char	EOC Character
ASCII String (hex) >	3A	30	30	51	44	44	42	2C	01	E1	2C	0D

The checksum of the characters in the example above can have values which range between 01E1 and 01EF hex.

2.2 Advantage Reply - to - Host Frame

The reply frame consists of 7 components; the SOC character, the unit ID, the reply prefix, the group ID code, the data item fields, the checksum and the EOC character. When replying to a QDDB through QDDG query command, the Advantage sends all information contained within the group to which the command corresponds. The Query Command, Reply Frame Header and the Data Groups have the following correspondence:

Query Header & Op Code	Reply Header	Data Group Number	Data Group Description	Query Header & Op Code	Reply Header	Data Group Number	Data Group Description
:00QDDB	:00AB	1	Measurements	:00QDDF	:00AF	5	Transformer Parameters
:00QDDC	:00AC	2	Alarms 1-6	:00QDDG	:00AG	6	System Parameters
:00QDDD	:00AD	3	Alarms 7-12	:00QDDI	:00AI	7	Miscellaneous Parameters
:00QDDE	:00AE	4	Analog Retransmit	:00QDDJ	:00AJ	8	Timer Parameters

The following is a shortened example of the Advantage Reply Frame for Op Code QDDB, showing only the winding temperature response of 123.4 °C. Note that the actual reply frame will contain all data items shown in section 2.3.

Frame Representation>	:	0	0	A	B	,	1	2	3	4	,	01	E1	,	CR
	SOC Character	Unit ID Char 1	Unit ID Char. 2	Reply Prefix	Group 1 ID Code	Separator Char	Data Item	Data Item	Data Item	Data Item	Separator Char	Checksum Hi Byte	Checksum Lo Byte	Separator Char	EOC Character
ASCII String (hex) >	3A	30	30	41	42	2C	31	32	33	34	2C	01	E1	2C	0D

Note that the reply prefix serves the same purpose as the command prefix in the query command, and the group ID code corresponds to character 3 of the query command's Op Code.

A full example of the general form of the reply frame corresponding to a QDDE (group 4, ID code "E") query command is illustrated below. The group 4 reply details the analog retransmit channel settings for up to 3 channels. The complete frame string for 3 channels of retransmit, would look like the following:

:00AE,2,4000,20000,0,1600,3,4000,20000,0,2000,4,0,10000,0,1000,CS,CR

Assuming the following configurations:

Channel Number	Source	Low Output (µa)	High Output (µa)	Zero Scale	Full Scale
1	Fluid	4000	20000	0 °C	160.0 °C
2	Winding	4000	20000	0 °C	200.0 °C
3	Load Current	0	10000	0 Amps	1000 Amps

See section 2.6 for details of data item assignments

Note that CS = checksum and CR = Carriage return, which is the EOC character. Note also that the full scale temperatures in the example string have had the radix removed in accordance with the general rules in section 2.0. The total byte count for the string is 88 and the checksum is 0BE0 hex.

2.2 Frame Component Table Conventions

In the frame component tables below the following conventions are used:

Label	Description
B	One byte used to encode an ASCII alpha or numeric character.
b	One Byte Used to Represent One of Three Decimal Numbers which in turn describe a Byte used Bitwise. For example, if a relay status byte has the bit pattern 1101 1110, this corresponds to a binary number whose decimal equivalent is 222. Thus the label in the table would appear as " **bbb** ".
:	Start of Command Character. Hex value 3A. Requires One Byte.
,	Frame component Separator. Hex Value 2C. Requires One Byte.

Abbreviated Sample Table

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	**:**						Single value 3A hex
Header 2, 3	Unit ID	**B**	**B**					Range 00 to 99
Header 4	Reply or Command Code	**B**						Single Hex Value 41 = Reply 42 = Command
Header 5	Reply Group ID	**B**						Single value for groups 1 - 6 Group 1 = 42 Hex Group 2 = 43 Hex Group 3 = 44 Hex Group 4 = 45 Hex Group 5 = 46 Hex Group 6 = 47 Hex Group 7 = 49 Hex Group 8 = 4A Hex
First Data Item	Item name	**,**	**B**					Range's Minimum and Maximum Values
Last Data Item	Item Name	**,**	**B**	**B**	**B**	**B**	**B**	Note that Some values have 1 or 2-place radix positioning. Host software must re-position the radix properly.
Trailer 1-3	Checksum	**,**	**B**	**B**				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	**,**	**B**					Single value 0D hex (Carriage Return)

Note that if a single unit is being communicated with, only header items 4 and 5, and trailer items 2 and 3 change for any communication function. If, for example, you read the configuration of the alarm relays 1-6 (group 2) and wanted to send the same data back as a configuration command, you would only need to change header item 4 from 41 to 42 hex and add 01 hex to the checksum before transmitting the string back as a command.

2.3 Group 1 “Measurements” Reply - to - Host Frame Expansion

The numbers shown in the Frame component column tabulate the maximum number of bytes which can be present in the frame build. In practice the maximum values will never occur for all frame components simultaneously, and since the frame component layouts are not padded for leading zeroes, total frame length will vary with changes in the magnitudes of measured values. The maximum frame length for the group 1 frame is 238 bytes.

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	:						Single value 3A hex
Header 2, 3	Unit ID	**B**	**B**					Range 00 to 99
Header 4	Reply Code	**B**						Single Value 41 hex
Header 5	Reply Group ID	**B**						Single value for group 1, 42 hex
Data Item 1-5	Winding Temperature	,	**B**	**B**	**B**	**B**		Range -999 to 9999 (-99.9 to 999.9)
Data Item 6-10	Fluid Temperature	,	**B**	**B**	**B**	**B**		Range -999 to 9999 (-99.9 to 999.9)
Data Item 11-16	Load Current	,	**B**	**B**	**B**	**B**	**B**	Range 0 to 99999
Data Item 17-21	Winding Peak Temp	,	**B**	**B**	**B**	**B**		Range -999 to 9999 (-99.9 to 999.9)
Data Item 22-24	Winding Peak Time Month	,	**B**	**B**				Range 1 to 12
Data Item 25-27	Winding Peak Time Day	,	**B**	**B**				Range 1 to 31
Data Item 28-32	Winding Peak Time Year	,	**B**	**B**	**B**	**B**		Range 2003 to 2099
Data Item 33-35	Winding Peak Time Hour	,	**B**	**B**				Range 0 to 23
Data Item 36-38	Winding Peak Time Minute	,	**B**	**B**				Range 0 to 59
Data Item 39-41	Winding Peak Time Second	,	**B**	**B**				Range 0 to 59
Data Item 42-46	Fluid Peak Temp	,	**B**	**B**	**B**	**B**		Range -999 to 9999 (-99.9 to 999.9)
Data Item 47-49	Fluid Peak Time Month	,	**B**	**B**				Range 1 to 12
Data Item 50-52	Fluid Peak Time Day	,	**B**	**B**				Range 1 to 31
Data Item 53-57	Fluid Peak Time Year	,	**B**	**B**	**B**	**B**		Range 2003 to 2099
Data Item 58-60	Fluid Peak Time Hour	,	**B**	**B**				Range 0 to 23
Data Item 61-63	Fluid Peak Time Minute	,	**B**	**B**				Range 0 to 59
Data Item 64-66	Fluid Peak Time Second	,	**B**	**B**				Range 0 to 59
Data Item 67-72	Load Current Peak	,	**B**	**B**	**B**	**B**	**B**	Range -999 to 9999 (-99.9 to 999.9)
Data Item 73-75	Load Peak Time Month	,	**B**	**B**				Range 1 to 12
Data Item 76-78	Load Peak Time Day	,	**B**	**B**				Range 1 to 31
Data Item 79-83	Load Peak Time Year	,	**B**	**B**	**B**	**B**		Range 2003 to 2099
Data Item 84-86	Load Peak Time Hour	,	**B**	**B**				Range 0 to 23
Data Item 87-89	Load Peak Time Minute	,	**B**	**B**				Range 0 to 59
Data Item 90-92	Load Peak Time Second	,	**B**	**B**				Range 0 to 59
Data Item 93-97	Winding Valley Temp	,	**B**	**B**	**B**	**B**		Range -999 to 9999 (-99.9 to 999.9)
Data Item 98-100	Winding Valley Time Mon.	,	**B**	**B**				Range 1 to 12
Data Item 101-103	Winding Valley Time Day	,	**B**	**B**				Range 1 to 31
Data Item 104-108	Winding Valley Time Year	,	**B**	**B**	**B**	**B**		Range 2003 to 2099
Data Item 109-111	Winding Valley Time Hour	,	**B**	**B**				Range 0 to 23
Data Item 112-114	Winding Valley Time Min.	,	**B**	**B**				Range 0 to 59
Data Item 115-117	Winding Valley Time Sec.	,	**B**	**B**				Range 0 to 59
Data Item 118-122	Fluid Valley Temp	,	**B**	**B**	**B**	**B**		Range -999 to 9999 (-99.9 to 999.9)
Data Item 123-125	Fluid Valley Time Mon.	,	**B**	**B**				Range 1 to 12
Data Item 126-128	Fluid Valley Time Day	,	**B**	**B**				Range 1 to 31
Data Item 129-133	Fluid Valley Time Year	,	**B**	**B**	**B**	**B**		Range 2003 to 2099
Data Item 134-136	Fluid Valley Time Hour	,	**B**	**B**				Range 0 to 23
Data Item 137-139	Fluid Valley Time Min.	,	**B**	**B**				Range 0 to 59

Data Item 140-142	Fluid Valley Time Sec.	,	B	B				Range 0 to 59
Data Item 143-148	Load Current Valley	,	B	B	B	B	B	Range 0 to 99999
Data Item 149-151	Load Valley Time Mon.	,	B	B				Range 1 to 12
Data Item 152-154	Load Valley Time Day	,	B	B				Range 1 to 31
Data Item 155-159	Load Valley Time Year	,	B	B				Range 2003 to 2099
Data Item 160-162	Load Valley Time Hour	,	B	B				Range 0 to 23
Data Item 163-165	Load Valley Time Min.	,	B	B				Range 0 to 59
Data Item 166-168	Load Valley Time Sec.	,	B	B				Range 0 to 59
Data Item 169-172	Relay 1 to 8 Status	,	b	b	b			Range 0 - 255 Used Bitwise Bits 0 to 7 Correspond to Relays 1 to 8 0 = De-energized, 1 = Energized Bit 7 = Relay 5 Bit 6 = Relay 6 Bit 5 = Relay 7,Aux Bit 4 = Relay 8 SFR Bit 3 = Relay 1 Bit 2 = Relay 2 Bit 1 = Relay 3 Bit 0 = Relay 4
Data Item 173-176	Relay 9 to 12 Status	,	b	b	b			Range 0 - 255 (0 - 16 valid) Used Bitwise Bits 0 to 3 Correspond to Relays 9 to 12 0 = De-energized, 1 = Energized Bit 7 = Future Bit 6 = Future Bit 5 = Future Bit 4 = Future Bit 3 = Relay 9 Bit 2 = Relay 10 Bit 1 = Relay 11 Bit 0 = Relay 12
Trailer 1-3	Checksum	,	B	B				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	,	B					Single value 0D hex (Carriage Return)

2.4 Group 2 "Alarm Relay 1 to 6 Setup" Reply - to - Host Frame Expansion

The alarm relay setup frame build for reply to host and configuration commands is identical. Only the directional code (reply or command) of header item 4 and the group code of header item 5 is changed. Changing these codes reflects whether the string contains a report from Advantage detailing what its current configuration is (reply), or a command from the host detailing what the Advantage's new configuration will be (command). The maximum frame length is 124 bytes.

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	:						Single value 3A hex
Header 2, 3	Unit ID	B	B					Range 00 to 99
Header 4	Reply Code	B						Single Value 41 hex
Header 5	Reply Group ID	B						Single value for group 2, 43 hex
Data Item 1-4	Alarm 1 Setup A	,	b	b	b			Range 0-255 Used Bitwise Bit 7 Relay Sequencing 0 = Disabled, 1 = Enabled Bit 6 Relay Check 0 = Disabled, 1 = Enabled Bits 5, 4, 3, 2 Trip Source 0000 = Remote, 0010 = Fluid 0011 = Winding, 0100 = Load Current Bit 1 Sensor Failure Function 0 = Off, 1 = On Bit 0 Un-Alarmed (Normal) State 0 = De-Energized, 1 = Energized

Frame Component	Description	Layout						Range and Significance
Data Item 5-8	Alarm 1 Setup B	,	b	b	b			Range 0-255 Used Bitwise Bit 7 Seasonal Setback 0 = Disabled, 1 = Enabled Bit 6, 5 Trigger 00 = None, 01 = Daily, 10 = Calendar, 11 = Both Bits 4, 3, 2 Connected Cooling Equip. 000 = Alarm, 001 = Fan, 010 = Pump 011 = Spray, 100 = None 101 = Change Bits 1, 0 Sensor Fail Effect 00 = De-Energize Relay Coil 01 = Energize Relay Coil 10 = Toggle Relay Coil State
Data Item 9-14	Alarm 1 Set Point Value	,	B	B	B	B	B	Range 0 to 99999 for Current Range -999 to 9999 for Temperatures
Data Item 15-19	Alarm 1 Hysteresis	,	B	B	B	B		Range 0 to 9999 for Current Range 0 to 200 for Temperatures
Data Item 20-23	Alarm 2 Setup A	,	b	b	b			Same as Relay 1 Setup A
Data Item 24-27	Alarm 2 Setup B	,	b	b	b			Same as Relay 1 Setup B
Data Item 28-33	Alarm 2 Set Point Value	,	B	B	B	B	B	Range 0 to 99999 for Current Range -999 to 9999 for Temperatures
Data Item 34-38	Alarm 2 Hysteresis	,	B	B	B	B		Range 0 to 9999 for Current Range 0 to 200 for Temperatures
Data Item 39-42	Alarm 3 Setup A	,	b	b	b			Same as Relay 1 Setup A
Data Item 43-46	Alarm 3 Setup B	,	b	b	b			Same as Relay 1 Setup B
Data Item 47-52	Alarm 3 Set Point Value	,	B	B	B	B	B	Range 0 to 99999 for Current Range -999 to 9999 for Temperatures
Data Item 53-57	Alarm 3 Hysteresis	,	B	B	B	B		Range 0 to 9999 for Current Range 0 to 200 for Temperatures
Data Item 58-61	Alarm 4 Setup A	,	b	b	b			Same as Relay 1 Setup A
Data Item 62-65	Alarm 4 Setup B	,	b	b	b			Same as Relay 1 Setup B
Data Item 66-71	Alarm 4 Set Point Value	,	B	B	B	B	B	Range 0 to 99999 for Current Range -999 to 9999 for Temperatures
Data Item 72-76	Alarm 4 Hysteresis	,	B	B	B	B		Range 0 to 9999 for Current Range 0 to 200 for Temperatures
Data Item 77-80	Alarm 5 Setup A	,	b	b	b			Same as Relay 1 Setup A
Data Item 81-84	Alarm 5 Setup B	,	b	b	b			Same as Relay 1B Setup B
Data Item 85-90	Alarm 5 Set Point Value	,	B	B	B	B	B	Range 0 to 99999 for Current Range -999 to 9999 for Temperatures
Data Item 91-95	Alarm 5 Hysteresis	,	B	B	B	B		Range 0 to 9999 for Current Range 0 to 200 for Temperatures
Data Item 96-99	Alarm 6 Setup A	,	b	b	b			Same as Relay 1 Setup A
Data Item 100-103	Alarm 6 Setup B	,	b	b	b			Same as Relay 1 Setup B
Data Item 104-109	Alarm 6 Set Point Value	,	B	B	B	B	B	Range 0 to 99999 for Current Range -999 to 9999 for Temperatures
Data Item 110-114	Alarm 6 Hysteresis	,	B	B	B	B		Range 0 to 9999 for Current Range 0 to 200 for Temperatures
Trailer 1-3	Checksum	,	B	B				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	,	B					Single value 0D hex (Carriage Return)

2.5 Group 3 “Alarm Relay 7 to 12 Setup” Reply - to - Host Frame Expansion

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	:						Single value 3A hex
Header 2, 3	Unit ID	**B**	**B**					Range 00 to 99
Header 4	Reply Code	**B**						Single Value 41 hex
Header 5	Reply Group ID	**B**						Single value for group 3, 44 hex
Data Item 1	Alarm 8 (SFR) Normal Coil State	**B**						Range 0 - 1 0 = De Energized, 1 = Energized
Data Item 2-5	Alarm 7 (Aux) Setup A	,	**b**	**b**	**b**			Range 0-255 Used Bitwise Bit 7 Relay Sequencing 0 = Disabled, 1 = Enabled Bit 6 Relay Check 0 = Disabled, 1 = Enabled Bits 5, 4, 3, 2 Trip Source 0000 = Remote, 0010 = Fluid 0011 = Winding, 0100 = Load Current Bit 1 Sensor Failure Function 0 = Off, 1 = On Bit 0 Un-Alarmed (Normal) State 0 = De-Energized, 1 = Energized
Data Item 6-9	Alarm 7 (Aux) Setup B	,	**b**	**b**	**b**			Range 0-255 Used Bitwise Bit 7 Seasonal Setback 0 = Disabled, 1 = Enabled Bit 6, 5 Trigger 00 = None, 01 = Daily, 10 = Calendar, 11 = Both Bits 4, 3, 2 Connected Cooling Equip. 000 = Alarm, 001 = Fan, 010 = Pump 011 = Spray, 100 = None 101 = Change Bits 1, 0 Sensor Fail Effect 00 = De-Energize Relay Coil 01 = Energize Relay Coil 10 = Toggle Relay Coil State
Data Item 10-15	Alarm 7 (Aux) Set Point Value	,	**B**	**B**	**B**	**B**	**B**	Range 0 to 99999 for Current Range -999 to 9999 for Temperatures
Data Item 16-20	Alarm 7 (Aux) Hysteresis	,	**B**	**B**	**B**	**B**		Range 0 to 9999 for Current Range 0 to 200 for Temperatures
Data Item 21-24	Alarm 9 Setup A	,	**b**	**b**	**b**			Same as Relay 7 Setup A
Data Item 25-28	Alarm 9 Setup B	,	**b**	**b**	**b**			Same as Relay 7 Setup B
Data Item 29-34	Alarm 9 Set Point Value	,	**B**	**B**	**B**	**B**	**B**	Range 0 to 99999 for Current Range -999 to 9999 for Temperatures
Data Item 35-39	Alarm 9 Hysteresis	,	**B**	**B**	**B**	**B**		Range 0 to 9999 for Current Range 0 to 200 for Temperatures
Data Item 40-43	Alarm 10 Setup A	,	**b**	**b**	**b**			Same as Relay 7 Setup A
Data Item 44-47	Alarm 10 Setup B	,	**b**	**b**	**b**			Same as Relay 7 Setup B
Data Item 48-53	Alarm 10 Set Point Value	,	**B**	**B**	**B**	**B**	**B**	Range 0 to 99999 for Current Range -999 to 9999 for Temperatures
Data Item 54-58	Alarm 10 Hysteresis	,	**B**	**B**	**B**	**B**		Range 0 to 9999 for Current Range 0 to 200 for Temperatures
Data Item 59-62	Alarm 11 Setup A	,	**b**	**b**	**b**			Same as Relay 7 Setup A
Data Item 63-66	Alarm 11 Setup B	,	**b**	**b**	**b**			Same as Relay 7 Setup B
Data Item 67-72	Alarm 11 Set Point Value	,	**B**	**B**	**B**	**B**	**B**	Range 0 to 99999 for Current Range -999 to 9999 for Temperatures

Frame Component	Description	Layout						Range and Significance
Data Item 73-77	Alarm 11 Hysteresis	,	B	B	B	B		Range 0 to 9999 for Current Range 0 to 200 for Temperatures
Data Item 78-81	Alarm 12 Setup A	,	b	b	b			Same as Relay 7 Setup A
Data Item 82-85	Alarm 12 Setup B	,	b	b	b			Same as Relay 7 Setup B
Data Item 86-91	Alarm 12 Set Point Value	,	B	B	B	B	B	Range 0 to 99999 for Current Range -999 to 9999 for Temperatures
Data Item 92-96	Alarm 12 Hysteresis	,	B	B	B	B		Range 0 to 9999 for Current Range 0 to 200 for Temperatures
Trailer 1-3	Checksum	,	B	B				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	,	B					Single value 0D hex (Carriage Return)

2.6 Group 4 "Analog Retransmit Setup" Reply - to - Host Frame Expansion

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	:						Single value 3A hex
Header 2, 3	Unit ID	B	B					Range 00 to 99
Header 4	Reply Code	B						Single Value 41 hex
Header 5	Reply Group ID	B						Single value for group 4, 45 hex
Data Item 1-2	Channel 1 Source	,	B					Range 1 - 255 (1 - 9 valid) 2 = Fluid, 3 = Winding 4 = Load Current
Data Item 3 - 8	Channel 1 Zero Scale	,	B	B	B	B	B	Range 0 - 24000 (µa)
Data Item 9 - 14	Channel 1 Full Scale	,	B	B	B	B	B	Range 0 - 24000 (µa)
Data Item 15-20	Channel 1 Zero Scale Temp	,	B	B	B	B	B	Range -400 to 2500 (Temperature) Range 0 to 99999 (Current)
Data Item 21-26	Channel 1 Full Scale Temp.	,	B	B	B	B	B	Range -400 to 2500 (Temperature) Range 0 - 99999 (Current)
Data Item 27, 28	Channel 2 Source	,	B					Range 1 - 255 (1 - 9 valid) 2 = Fluid, 3 = Winding 4 = Load Current
Data Item 29 - 34	Channel 2 Zero Scale	,	B	B	B	B	B	Range 0 - 24000 (µa)
Data Item 35 - 40	Channel 2 Full Scale	,	B	B	B	B	B	Range 0 - 24000 (µa)
Data Item 41 - 46	Channel 2 Zero Scale Temp	,	B	B	B	B	B	Range -400 to 2500 (Temperature) Range 0 to 99999 (Current)
Data Item 47 - 52	Channel 2 Full Scale Temp.	,	B	B	B	B	B	Range -400 to 2500 (Temperature) Range 0 - 99999 (Current)
Data Item 53, 54	Channel 3 Source	,	B					Range 1 - 255 (1 - 9 valid) 2 = Fluid, 3 = Winding 4 = Load Current
Data Item 55 - 60	Channel 3 Zero Scale	,	B	B	B	B	B	Range 0 - 24000 (µa)
Data Item 61 - 66	Channel 3 Full Scale	,	B	B	B	B	B	Range 0 - 24000 (µa)
Data Item 67 - 72	Channel 3 Zero Scale Temp	,	B	B	B	B	B	Range -400 to 2500 (Temperature) Range 0 to 99999 (Current)
Data Item 73 - 78	Channel 3 Full Scale Temp.	,	B	B	B	B	B	Range -400 to 2500 (Temperature) Range 0 - 99999 (Current)
Trailer 1-3	Checksum	,	B	B				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	,	B					Single value 0D hex (Carriage Return)

2.7 Group 5 “Transformer Parameters” Reply - to - Host Frame Expansion

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	:						Single value 3A hex
Header 2, 3	Unit ID	B	B					Range 00 to 99
Header 4	Reply Code	B						Single Value 41 hex
Header 5	Reply Group ID	B						Single value for group 5, 46 hex
Data Item 1-2	Fluid Type	,	B					Range 0 - 1, 0 = Silicone, 1 = Mineral Oil
Data Item 3 - 8	Fluid Capacity	,	B	B	B	B	B	Range 500 - 50000 (Gallons)
Data Item 9, 10	Fluid Circulation	,	B					Range 0 - 2 0 = Forced (OF), 1 = Natural (ON) 2 = Directed (OD)
Data Item 11, 12	Air Circulation	,	B					Range 0 - 1 0 = Forced (AF), 1 = Natural (AN)
Data Item 13, 14	Winding Type	,	B					Range 0 - 1 0 = Cylindrical, 1 = Rectangular
Data Item 15 - 20	Core Weight	,	B	B	B	B	B	Range 0 - 99999 (Tons)
Data Item 21 - 26	Maximum Load Current	,	B	B	B	B	B	Range 0 - 99999 (Amps)
Data Item 27 - 32	Capacity Rating	,	B	B	B	B	B	Range 0 - 99999 (0 - 999.99 MVA)
Data Item 33 - 36	Gradient (ON Rating)	,	B	B	B			Range 0 -750 (0-75.0 Degrees C)
Data Item 37 - 40	Gradient (OF Rating)	,	B	B	B			Range 0 -750 (0-75.0 Degrees C)
Data Item 41 - 44	Gradient (OD Rating)	,	B	B	B			Range 0 -750 (0-75.0 Degrees C)
Data Item 45 - 49	Low Voltage Winding Res	,	B	B	B	B		Range 0 - 2000 (milliohms)
Data Item 50 - 54	High Voltage Winding Res	,	B	B	B	B		Range 0 - 5000 (0 - 50.00 Ohms)
Trailer 1-3	Checksum	,	B	B				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	,	B					Single value 0D hex (Carriage Return)

2.8 Group 6 “Transformer Parameters” Reply - to - Host Frame Expansion

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	:						Single value 3A hex
Header 2, 3	Unit ID	B	B					Range 00 to 99
Header 4	Reply Code	B						Single Value 41 hex
Header 5	Reply Group ID	B						Single value for group 6, 47 hex
Data Item 1-2	Future Use	,	B					Always 0
Data Item 3 - 7	Step	,	B	B	B	B		Range -2000 to 0 (-20.00 to 0 °C)
Data Item 8 - 13	Delay	,	B	B	B	B	B	Range 0 - 99999 (Seconds)
Data Item 14, 15	Operator Mode	,	B					Range 0 - 1, 0 = Disabled, 1 = Enabled
Data Item 16, 17	Display Flash	,	B					Range 0 - 1, 0 = Disabled, 1 = Enabled
Data Item 18 - 22	RTD 1 Offset	,	B	B	B	B		Range -250 to 250 (-25.0 to +25.0 °C)
Data Item 23 - 27	Future Use	,	B	B	B	B		Always 0000
Data Item 28 - 32	Future Use	,	B	B	B	B		Always 0000
Data Item 33 - 34	Display Conserver	,	B					Range 0 - 1, 0 = Disabled, 1 = Enabled
Trailer 1-3	Checksum	,	B	B				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	,	B					Single value 0D hex (Carriage Return)

2.9 Group 7 “Miscellaneous Parameter” Reply - to - Host Frame Expansion

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	:						Single value 3A hex
Header 2, 3	Unit ID	**B**	**B**					Range 00 to 99
Header 4	Command Code	**B**						Single Value 41 hex
Header 5	Group ID	**B**						Single value for group 7, 49 hex
Data Item 1, 2	Peak or Valley Event Recording Mode	,	**B**					Peak and Valley Recording Mode 0 = Continuous (Manual Reset) 1 = Hourly (Auto Reset on the Hour)
Data Item 3. 4	Scale	,	**B**					Scale: 0 = 200 °C , 1 = 250 °C
Trailer 1-3	Checksum	,	**B**	**B**				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	,	**B**					Single value 0D hex (Carriage Return)

2.10 Group 8 “Timer Parameter” Reply-to-Host Frame Expansion

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	:						Single value 3A
Header 2, 3	Unit ID	**B**	**B**					Range 00 to 99
Header 4	Command Code	**B**						Single Value 43 hex
Header 5	Group ID	**B**						Single value for group 4, 4A hex
Data Items 1, 2	Daylight Savings	,	**B**					Auto Adjust:0 = Disabled, 1 = Enabled
Data Items 3 - 7	Temp Seasonal Setback	,	**B**	**B**	**B**	**B**		Setback Temperature -500 to 500 (-50.0 to 50.0 °C)
Data Items 8 - 12	Current Seasonal Setback	,	**B**	**B**	**B**	**B**		Load Current Setback -500 to 500 (-500 to 500 Amps)
Data Items 13 - 15	Start Mon Season Setback	,	**B**	**B**				Start Month: 01 - 12
Data Items 16 - 18	Start Day Season Setback	,	**B**	**B**				Start Day: 01 - 31
Data Items 19 - 21	Start Hour Season Setback	,	**B**	**B**				Start Hour: 00 - 23
Data Items 22 - 24	Start Min Season Setback	,	**B**	**B**				Start Minute: 00 - 59
Data Items 25 - 27	End Mon Season Setback	,	**B**	**B**				End Month: 01 - 12
Data Items 28 - 30	End Day Season Setback	,	**B**	**B**				End Day: 01 - 31
Data Items 31 - 33	End Hour Season Setback	,	**B**	**B**				End Hour: 00 - 23
Data Items 34 - 36	End Min Season Setback	,	**B**	**B**				End Minute: 00 - 59
Data Items 37 - 39	Start Hour Daily Alarm	,	**B**	**B**				Start Hour: 00 - 23
Data Items 40 - 42	Start Minute Daily Alarm	,	**B**	**B**				Start Minute: 00 - 59
Data Items 43 - 45	Run Length Hours Daily AL	,	**B**	**B**				Run length in hours: 00 - 23
Data Items 46 - 48	Run Length Min Daily AL	,	**B**	**B**				Run length in minutes: 00 - 59
Data Items 49 - 51	Start Month Calendar Alarm	,	**B**	**B**				Start Month: 01 - 12
Data Items 52 - 54	Start Day Calendar Alarm	,	**B**	**B**				Start Day: 01 - 31
Data Items 55 - 57	Start Hour Calendar Alarm	,	**B**	**B**				Start Hour: 00 - 23
Data Items 58-60	Start Min Calendar Alarm	,	**B**	**B**				Start Minute: 00 - 59
Data Items 61 - 63	End Month Calendar Alarm	,	**B**	**B**				End Month: 01 - 12
Data Items 64 - 66	End Day Calendar Alarm	,	**B**	**B**				End Day: 01 - 31
Data Items 67 - 69	End Hour Calendar Alarm	,	**B**	**B**				End Hour: 00 - 23
Data Items 70 - 72	End Minute Calendar Alarm	,	**B**	**B**				End Minute: 00 - 59
Trailer 1-3	Checksum	,	**B**	**B**				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	,	**B**					Single value 0D hex (Carriage Return)

2.11 Group 2 “Alarms 1 to 6 Set up” Command Frame Expansion

The frames for the group 2 configuration commands are built identically to the group 2 reply - to - host frames with the single exception that header item 4 is changed from the reply code “A” (41 hex) to the command code “C” (43 hex). Thus a single, or multiple data items in a setup group can be easily changed by requesting a reply string, selecting and changing the item, changing the reply code to the command code and sending it out as a command. Note that the data groups covered by the command codes are 2 - 6, codes C - G. Please see the frame table of section 2.4 for descriptions of data items 1-114.

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	**:**						Single value 3A hex
Header 2, 3	Unit ID	**B**	**B**					Range 00 to 99
Header 4	Command Code	**B**						Single Value 43 hex
Header 5	Command Group ID	**B**						Single value for group 2, 43 hex
Data Items 1-114	See Group 2 Reply Table							
Trailer 1-3	Checksum	**,**	**B**	**B**				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	**,**	**B**					Single value 0D hex (Carriage Return)

2.12 Group 3 “Alarm Relays 7 - 12 Set up” Command Frame Expansion

The frames for the group 3 configuration commands are built identically to the group 3 reply - to - host frames with the single exception that header item 4 is changed from the reply code “A” (41 hex) to the command code “C” (43 hex). Please see the frame table of section 2.5 for descriptions of data items 1-114.

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	**:**						Single value 3A hex
Header 2, 3	Unit ID	**B**	**B**					Range 00 to 99
Header 4	Command Code	**B**						Single Value 43 hex
Header 5	Group ID	**B**						Single value for group 3, 44 hex
Data Items 1 - 114	See Group 3 Reply Table							
Trailer 1-3	Checksum	**,**	**B**	**B**				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	**,**	**B**					Single value 0D hex (Carriage Return)

2.13 Group 4 “Analog Retransmit Set up” Command Frame Expansion

The frames for the group 4 configuration commands are built identically to the group 4 reply - to - host frames with the single exception that header item 4 is changed from the reply code “A” (41 hex) to the command code “C” (43 hex). Please see the frame table of section 2.6 for descriptions of data items 1-78.

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	**:**						Single value 99
Header 2, 3	Unit ID	**B**	**B**					Range 00 to 63 hex
Header 4	Command Code	**B**						Single Value 43 hex
Header 5	Group ID	**B**						Single value for group 4, 45 hex
Data Items 1 - 78	See Group 3 Reply Table							
Trailer 1-3	Checksum	**,**	**B**	**B**				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	**,**	**B**					Single value 0D hex (Carriage Return)

2.14 Group 5 “Transformer Parameter Set up” Command Frame Expansion

The frames for the group 5 configuration commands are built identically to the group 5 reply - to - host frames with the single exception that header item 4 is changed from the reply code “A” (41 hex) to the command code “C” (43 hex). Please see the frame table of section 2.7 for descriptions of data items 1-54.

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	**:**						Single value 3A hex
Header 2, 3	Unit ID	**B**	**B**					Range 00 to 99
Header 4	Command Code	**B**						Single Value 43 hex
Header 5	Group ID	**B**						Single value for group 5, 46 hex
Data Items 1 - 54	See Group 5 Reply Table							
Trailer 1-3	Checksum	**,**	**B**	**B**				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	**,**	**B**					Single value 0D hex (Carriage Return)

2.15 Group 6 “Transformer Parameter Set up” Command Frame Expansion

The frames for the group 6 configuration commands are built identically to the group 6 reply - to - host frames with the single exception that header item 4 is changed from the reply code “A” (41 hex) to the command code “C” (43 hex). Please see the frame table of section 2.8 for descriptions of data items 1-34.

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	**:**						Single value 3A hex
Header 2, 3	Unit ID	**B**	**B**					Range 00 to 99
Header 4	Command Code	**B**						Single Value 43 hex
Header 5	Group ID	**B**						Single value for group 6, 47 hex
Data Items 1 - 34	See Group 6 Reply Table							
Trailer 1-3	Checksum	**,**	**B**	**B**				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	**,**	**B**					Single value 0D hex (Carriage Return)

2.16 Group 7 “Miscellaneous Parameter Set up” Command Frame Expansion

The frames for the group 7 configuration commands are built identically to the group 7 reply - to - host frames with the single exception that header item 4 is changed from the reply code “A” (41 hex) to the command code “C” (43 hex).

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	**:**						Single value 3A hex
Header 2, 3	Unit ID	**B**	**B**					Range 00 to 99
Header 4	Command Code	**B**						Single Value 43 hex
Header 5	Group ID	**B**						Single value for group 7, 49 hex
Data Item 1, 2	Peak or Valley Event Recording Mode	**,**	**B**					Peak and Valley Recording Mode 0 = Continuous (Manual Reset) 1 = Daily (Auto Reset at 0:00 Hours)
Data Items 3, 4	Scale	**,**	**B**					High End Scale: 0 =200, 1 = 250 °C
Trailer 1-3	Checksum	**,**	**B**	**B**				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	**,**	**B**					Single value 0D hex (Carriage Return)

2.17 Group 8 “Timer Parameters Set Up” Frame Expansion

The frames for the group 8 configuration commands are built identically to the group 8 reply - to - host frames with the single exception that header item 4 is changed from the reply code “A” (41 hex) to the command code “C” (43 hex).

Frame Component	Description	Layout						Range and Significance
Header 1	SOC Character	**:**						Single value 3A hex
Header 2, 3	Unit ID	**B**	**B**					Range 00 to 99
Header 4	Command Code	**B**						Single Value 43 hex
Header 5	Group ID	**B**						Single value for group 8, 4A hex
Data Items 1 - 72	See Group 8 Reply Table							
Trailer 1-3	Checksum	**,**	**B**	**B**				Range 0000 - FFFF Hex
Trailer 4, 5	EOC Character	**,**	**B**					Single value 0D hex (Carriage Return)

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DEVICE PROFILE DOCUMENT

This table must be accompanied by a table having the following headings:

Object Group	Request Function Codes	Response Function Codes
Object Variation	Request Qualifiers	Response Qualifiers
	Object Name (optional)	

Vendor Name: Weschler Instruments

Device Name: Advantage CT

Highest DNP Level Supported:	Device Function:
For Requests: Level 1 For Responses: Level 1	**G** Master **O** Slave

Notable objects, functions and/or qualifiers supported in addition to the highest DNP levels Supported (the complete list is described in the attached table):

Maximum Data Link Frame Size (octets):	Maximum Application Fragment Size (octets):
Transmitted: 292 Received: 292	Transmitted: 249 Received: 249

Maximum Data Link Re-tries:	Maximum Application Layer Re-tries:
O None **G** Fixed at _____ **G** Configurable, range ____ to ____	**O** None **G** Configurable, range _____ to _____ (fixed is not permitted)

Requires Data Link Layer Confirmation:

O Never
G Always
G Sometimes If 'Sometimes', when? _____
G Configurable If 'Configurable', how? _____

Requires Application Layer Confirmation:

G Never
G Always (not recommended)
O When reporting event data (Slave devices only)
G When sending multi-fragment responses (slave devices only)
G Sometimes If 'Sometimes', when? _____
G Configurable If 'Configurable', how? _____

Timeouts While Waiting For:

Data link confirm	**O** None	**G** Fixed at ___	**G** Variable	**G** Configurable*
Complete application fragment	**O** None	**G** Fixed at ___	**G** Variable	**G** Configurable*
Application confirm	**O** None	**G** Fixed at ___	**G** Variable	**G** Configurable*
Complete application response	**O** None	**G** Fixed at ___	**G** Variable	**G** Configurable*

Others _____

Attach an explanation if 'Variable' or 'Configurable' was checked for any timeout

Send / Executes Control Operations:

WRITE Binary Outputs	**O** Never	**G** Always	**G** Sometimes	**G** Configurable*
SELECT / OPERATE	**G** Never	**O** Always	**G** Sometimes	**G** Configurable*
DIRECT OPERATE	**G** Never	**O** Always	**G** Sometimes	**G** Configurable*
DIRECT OPERATE - NO ACK	**G** Never	**O** Always	**G** Sometimes	**G** Configurable*

Count > 1	**O** Never	**G** Always	**G** Sometimes	**G** Configurable*
Pulse On	**G** Never	**G** Always	**O** Sometimes	**G** Configurable*
Pulse Off	**G** Never	**G** Always	**O** Sometimes	**G** Configurable*
Latch On	**G** Never	**G** Always	**O** Sometimes	**G** Configurable*
Latch Off	**G** Never	**G** Always	**O** Sometimes	**G** Configurable*
Queue	**O** Never	**G** Always	**G** Sometimes	**G** Configurable*
Clear Queue	**O** Never	**G** Always	**G** Sometimes	**G** Configurable*

* See attached point table for control operations checked as 'Sometimes'

FILL OUT THE FOLLOWING ITEMS FOR MASTER DEVICES ONLY

Expects Binary Input Change Events:

G Either time-tagged or non-time-tagged for a single event.
G Both time-tagged and non-time-tagged for a single event.
G Configurable (attach explanation).

FILL OUT THE FOLLOWING ITEM FOR SLAVE DEVICES ONLY

Reports binary input change events when no specific variation requested;

G Never
O Only time-tagged
G Only non-time-tagged
G Configurable to send both, one, or the other (attach explanation)

Reports time-tagged binary input change events when no specific variation requested:

G Never
O Binary input change with time
G Binary input change with relative time
G Configurable (attach explanation)

Sends Unsolicited Responses:
O Never
G Configurable (attach explanation)
G Only certain objects
G Sometimes (attach explanation)
G ENABLE / DISABLE UNSOLICITED Function Codes Supported

Sends Static Data in Unsolicited Responses
O Never
G When device restarts
G When status flags change

No Other Options Are Permitted

Default Counter Object / Variation:	Counters Roll Over At:
G No counters reported **G** Configurable (attach explanation) **O** Default object 20 Default Variation 1 **G** Point-by-point list attached	**G** No counters reported **G** Configurable (attach explanation) **G** 16 Bits **O** 32 Bits **G** Other value _____ **G** point-by-point list attached
Sends Multi-Fragment Responses: **G** Yes **O** No	

Advantage CT Implementation Table

OBJECT			REQUEST (slave must parse)		RESPONSE (master must parse)	
GROUP	VARIATION	DESCRIPTION	Function Codes (decimal)	Qualifier Codes (hex)	Function Codes (decimal)	Qualifier Codes (hex)
1	2	Binary Input with Status			129	00,01
2	2	Binary Input Change with Time			129	17, 28
10	2	Binary Output Status			129	00, 01
12	1	Control Relay Output Block	3, 4, 5, 6	17, 28	129	echo of request
20	1	32 Bit Binary Counter			129	00, 01
30	1	32 Bit Analog Input			129	00, 01
40	2	16 Bit Analog Output status			129	00, 01
41	2	16 Bi8t Analog Output Block	3, 4, 5, 6	17, 28	129	echo of request
50	1	Time and Date	1, 2	07 quantity=1		
60	0	Class Zero Data Read		06		

Advantage CT Point Table

Object	Variation	Type	Point	Description
1	2	Binary Input with Status (Static, Read) Status Octet: Bit 7 = State (0, 1) Bit 6 = N/A Bit 5 = N/A Bit 4 = N/A Bit 3 = N/A Bit 2 = N/A Bit 1 = N/A Bit 0 = On / Off Line Bit 0: 0 = True (Off Line) 1 = False (On Line)	0 1 2 3 4 5	Winding Peak Value Fluid Peak Value Load Current Peak Value Winding Valley Value Fluid Valley Value Load Current Valley Value
2	2	Binary Input Change with Time (Read, Event) Status Octet: Bit 7 = State (0, 1) Bit 6 = N/A Bit 5 = N/A Bit 4 = N/A Bit 3 = N/A Bit 2 = N/A Bit 1 = N/A Bit 0 = On / Off Line Bit 0: 0 = True (Off Line) 1 = False (On Line)	0 1 2 3 4 5	Winding Temperature Peak. Fluid Temperature Peak. Load Current Peak. Winding Temperature Valley. Fluid Temperature Valley. Load Current Valley. Bit 7 is set, and the time is updated whenever a new peak or valley is recorded. The bit is cleared for a point immediately after the point's previous peak or valley is reset. Use this function in combination with object 30, variation 1 to time-stamp peak and valley values.

Object	Variation	Type	Point	Description
10	2	Binary Output With Status. (Static, Read) Status Octet: Bit 7 = State (0, 1) Bit 6 = N/A Bit 5 = N/A Bit 4 = N/A Bit 3 = N/A Bit 2 = N/A Bit 1 = N/A Bit 0 = On / Off Line Bit 0: 0 = Off Line 1 = On Line	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34	Relay 1 Remote Control. Enabled = 1, Disabled = 0 Relay 2 Remote Control. Enabled = 1, Disabled = 0 Relay 3 Remote Control. Enabled = 1, Disabled = 0 Relay 4 Remote Control. Enabled = 1, Disabled = 0 Relay 5 Remote Control. Enabled = 1, Disabled = 0 Relay 6 Remote Control. Enabled = 1, Disabled = 0 Relay 7 Remote Control. Enabled = 1, Disabled = 0 Relay 9 Remote Control. Enabled = 1, Disabled = 0 Relay 10 Remote Control. Enabled = 1, Disabled = 0 Relay 11 Remote Control. Enabled = 1, Disabled = 0 Relay 12 Remote Control. Enabled = 1, Disabled = 0 Relay 1 coil state. Energized = 1, De-energized = 0 Relay 2 coil state. Energized = 1, De-energized = 0 Relay 3 coil state. Energized = 1, De-energized = 0 Relay 4 coil state. Energized = 1, De-energized = 0 Relay 5 coil state. Energized = 1, De-energized = 0 Relay 6 coil state. Energized = 1, De-energized = 0 Relay 7 coil state. Energized = 1, De-energized = 0 Relay 8 coil state. Energized = 1, De-energized = 0 Relay 9 coil state. Energized = 1, De-energized = 0 Relay 10 coil state. Energized = 1, De-energized = 0 Relay 11 coil state. Energized = 1, De-energized = 0 Relay 12 coil state. Energized = 1, De-energized = 0 Relay 1 Normal Coil State. Energized = 1, De-energized = 0 Relay 2 Normal Coil State. Energized = 1, De-energized = 0 Relay 3 Normal Coil State. Energized = 1, De-energized = 0 Relay 4 Normal Coil State. Energized = 1, De-energized = 0 Relay 5 Normal Coil State. Energized = 1, De-energized = 0 Relay 6 Normal Coil State. Energized = 1, De-energized = 0 Relay 7 Normal Coil State. Energized = 1, De-energized = 0 Relay 8 Normal Coil State. Energized = 1, De-energized = 0 Relay 9 Normal Coil State. Energized = 1, De-energized = 0 Relay 10 Normal Coil State. Energized = 1, De-energized = 0 Relay 11 Normal Coil State. Energized = 1, De-energized = 0 Relay 12 Normal Coil State. Energized = 1, De-energized = 0

Object	Variation	Type	Point	Description
12	1	Control Relay Output Block. (Static, Write) Notes: In order to set or change the values of points 11 through 21, the corresponding relay's remote control function must be enabled. In order for local control to be restored to points 11 through 21, the relay's remote control function must be disabled.	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	Relay 1 Remote Control. See supported control codes. Relay 2 Remote Control. See supported control codes. Relay 3 Remote Control. See supported control codes Relay 4 Remote Control. See supported control codes Relay 5 Remote Control. See supported control codes Relay 6 Remote Control. See supported control codes Relay 7 Remote Control. See supported control codes Relay 9 Remote Control. See supported control codes Relay 10 Remote Control. See supported control codes Relay 11 Remote Control. See supported control codes Relay 12 Remote Control. See supported control codes Relay 1 Coil State. See supported control codes. Relay 2 Coil State. See supported control codes. Relay 3 Coil State. See supported control codes. Relay 4 Coil State. See supported control codes. Relay 5 Coil State. See supported control codes. Relay 6 Coil State. See supported control codes. Relay 7 Coil State. See supported control codes. Relay 9 Coil State. See supported control codes. Relay 10 Coil State. See supported control codes. Relay 11 Coil State. See supported control codes. Relay 12 Coil State. See supported control codes. Control Codes Supported: 0 = NUL 1 = Pulse on. Relay energized until timer times out. 2 = Pulse off. Relay de-energized until timer times out. 3 = Latch on. Local Control will not supercede if set point exceeded. 4 = Latch off. 5 through 15 are undefined. Queue, Clear and Trip/Close bits set to 0.
20	1	Binary Counter (Static, Read)	0 1 2	Advantage Model (3 to 9 = G3T to G9T) Firmware Version Number. (0-3E7 Hex) Firmware Revision Number (0-63 Hex)
30	1	32 Bit Analog Input with Status. (Static, Read) Status Octet: Bit 7 = N/A Bit 6 = Ref Check Bit 5 = N/A Bit 4 = N/A Bit 3 = N/A Bit 2 = N/A Bit 1 = N/A Bit 0 = Flag Bit 6: 0 = Normal 1 = Error Bit 0: 0 = True (Off Line) 1 = False (On Line)	0 1 2 3 4 5 6 7 8	Winding Temperature. Bit 0, 6 = Sensor, Internal Failure? Fluid Temperature. Bit 0, 6 = Sensor, Internal Failure? Load Current. Bit 0, 6 = Beyond 150%? Winding Temperature Peak. Fluid Temperature Peak. Load Current Peak. Winding Temperature Valley. Fluid Temperature Valley. Load Current Valley. See object 2, variation 2 for peak and valley time-stamp capability.

Object	Variation	Type	Point	Description
40	2	16 Bit Analog Output Status (Static, Read) Status Byte: Bit 7 = N/A Bit 6 = N/A Bit 5 = N/A Bit 4 = N/A Bit 3 = N/A Bit 2 = N/A Bit 1 = N/A Bit 0 = N/A See note 1 at the bottom of the table.	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	Alarm 1 Set Point Alarm 2 Set Point Alarm 3 Set Point Alarm 4 Set Point Alarm 5 Set Point Alarm 6 Set Point Alarm 7 Set Point Alarm 9 Set Point Alarm 10 Set Point Alarm11 Set Point Alarm 12 Set Point Alarm 1 Hysteresis Alarm 2 Hysteresis Alarm 3 Hysteresis Alarm 4 Hysteresis Alarm 5 Hysteresis Alarm 6 Hysteresis Alarm 7 Hysteresis Alarm 9 Hysteresis Alarm 10 Hysteresis Alarm 11 Hysteresis Alarm 12 Hysteresis
41	2	16 Bit Analog Output Block (Static, Write) Control Codes Supported: 0 = 0 (NUL) 1 = 0 2 = 0 3 = 0 4 = 0 5 through 15 are undefined. Queue = 0 Clear = 0 Trip/Close bit = 0 See note 2 at the bottom of the table.	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	Alarm 1 Set Point Alarm 2 Set Point Alarm 3 Set Point Alarm 4 Set Point Alarm 5 Set Point Alarm 6 Set Point Alarm 7 Set Point Alarm 9 Set Point Alarm 10 Set Point Alarm11 Set Point Alarm 12 Set Point Alarm 1 Hysteresis Alarm 2 Hysteresis Alarm 3 Hysteresis Alarm 4 Hysteresis Alarm 5 Hysteresis Alarm 6 Hysteresis Alarm 7 Hysteresis Alarm 9 Hysteresis Alarm 10 Hysteresis Alarm 11 Hysteresis Alarm 12 Hysteresis
50	1	Time & Date (Read & Write)	0	Time and Date
60	0	Class 0 Data (Read)	All	Using qualification code 06 returns all static data.

Notes:

1. Actual load current set point and displayed values are allowed to range from 0 to 99999 amps. Set point values for DNP-3 level 1 slaves, however; are limited to the range of $\pm 2^{15}$ -1 ($\pm$ 32767). In order to remain within that range, and alarm up to 99990 amps, the load current read from the data point is 1/10 of the actual value. The range of values read directly would therefore be 0 to 9999 (no negative range for load current) and the user's application program must multiply by 10 to restore the actual value of the set point. This limitation applies to load current values only.

2. For the reasons expressed in note 1, load current values which are written to the set point must be 1/10 of the actual value, up to a maximum of 9999 amps. The user's application program must divide the desired set point value by 10 to create the value which is written to the set point. This limitation applies to load current values only.