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Design Specification Entry
DS-20080806-01

Transformer Advantage ModBus Data Register Structure

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1) Abstract

The Modbus protocol uses several different types of memory management objects to facilitate referencing of data by applications. This design specification entry defines the structure that will be used by the Transformer Advantage for this purpose.

2) Scope

This specification is applicable to Advantage IIE models with firmware AMTSYS0201 revision 0 and higher.
Loss of Insulation Life and Alarms 13-24 support added for firmware AMTSYS0202 revision 0 and higher.

3) Register Definitions

3.1) Input Registers (Read Only - MODBUS Functions 04):

Register Number(s)	Size (bytes)	Advantage Data Name	Notes
0	2	Advantage Model code	
1	2	Firmware Version	
2	2	Firmware Revision	
3 - 9	-	None	Free
10	2	RTD Channel 1 present value	(2)
11	2	RTD Channel 1 Peak Value	(2)
12 - 14	6	RTD Channel 1 Peak Date/Time	(1)
15	2	RTD Channel 1 Valley Value	(2)
16 - 18	6	RTD Channel 1 Valley Date/Time	(1)
19	2	RTD Channel 2 present value	(2)
20	2	RTD Channel 2 Peak Value	(2)
21 - 23	6	RTD Channel 2 Peak Date/Time	(1)
24	2	RTD Channel 2 Valley Value	(2)
25 - 27	6	RTD Channel 2 Valley Date/Time	(1)
28	2	RTD Channel 3 present value	(2)
29	2	RTD Channel 3 Peak Value	(2)

Register Number(s)	Size (bytes)	Advantage Data Name	Notes
30 - 32	6	RTD Channel 3 Peak Date/Time	(1)
33	2	RTD Channel 3 Valley Value	(2)
34 - 36	6	RTD Channel 3 Valley Date/Time	(1)
37 - 99	-	None	Free
100	2	Winding 1 Present Temperature	(2) - CT series only
101	2	Winding 1 Peak Temperature	(2) - CT series only
102 - 104	6	Winding 1 Peak Date/Time	(1) - CT series only
105	2	Winding 1 Valley Temperature	(2) - CT series only
106 - 108	6	Winding 1 Valley Date/Time	(1) - CT series only
109	2	Winding 2 Present Temperature	(2) - CT series only
110	2	Winding 2 Peak Temperature	(2) - CT series only
111 - 113	6	Winding 2 Peak Date/Time	(1) - CT series only
114	2	Winding 2 Valley Temperature	(2) - CT series only
115 - 117	6	Winding 2 Valley Date/Time	(1) - CT series only
118	2	Winding 3 Present Temperature	(2) - CT series only
119	2	Winding 3 Peak Temperature	(2) - CT series only
120 - 122	6	Winding 3 Peak Date/Time	(1) - CT series only
123	2	Winding 3 Valley Temperature	(2) - CT series only
124 - 126	6	Winding 3 Valley Date/Time	(1) - CT series only
127	2	Highest Winding Present Temperature	(2) - CT series only
128	2	Highest Winding Peak Temperature	(2) - CT series only
129 - 131	6	Highest Winding Peak Date/Time	(1) - CT series only
132	2	Highest Winding Valley Temperature	(2) - CT series only
133 - 135	6	Highest Winding Valley Date/Time	(1) - CT series only
136 / 137	4	Current 1 Present Value	(3) - CT series only
138 / 139	4	Current 1 Peak	(3) - CT series only
140 - 142	6	Current 1 Peak Date/Time	(1) - CT series only
143 / 144	4	Current 1 Valley	(3) - CT series only
145 - 147	6	Current 1 Valley Date/Time	(1) - CT series only
148 / 149	4	Current 2 Present Value	(3) - CT series only
150 / 151	4	Current 2 Peak	(3) - CT series only
152 - 154	6	Current 2 Peak Date/Time	(1) - CT series only

Register Number(s)	Size (bytes)	Advantage Data Name	Notes
155 / 156	4	Current 2 Valley	(3) - CT series only
157 - 159	6	Current 2 Valley Date/Time	(1) - CT series only
160 / 161	4	Current 3 Present Value	(3) - CT series only
162 / 163	4	Current 3 Peak	(3) - CT series only
164 - 166	6	Current 3 Peak Date/Time	(1) - CT series only
167 / 168	4	Current 3 Valley	(3) - CT series only
169 - 171	6	Current 3 Valley Date/Time	(1) - CT series only
172 / 173	4	Highest Current Present Value	(3) - CT series only
174 / 175	4	Highest Current Peak	(3) - CT series only
176 - 178	6	Highest Current Peak Date/Time	(1) - CT series only
179 / 180	4	Highest Current Valley	(3) - CT series only
181 - 183	6	Highest Current Valley Date/Time	(1) - CT series only
184	2	LTC Differential Present Temperature	(2) - LTC & CT/LTC Only
185	2	LTC Differential Peak Temperature	(2) - LTC & CT/LTC Only
186 - 188	6	LTC Differential Peak Date/Time	(1) - LTC & CT/LTC Only
189	2	LTC Deviation Temperature	(2) - LTC & CT/LTC Only
190 - 192	6	LTC Deviation Date/Time	(1) - LTC & CT/LTC Only
193 / 194	4	LCAM Channel 1 Present Value	(3)(4)
195 / 196	4	LCAM Channel 2 Present Value	(3)(4)
197 / 198	4	LCAM Channel 3 Present Value	(3)(4)
199 / 200	4	LCAM Channel 4 Present Value	(3)(4)
201 / 202	4	LCAM Channel 5 Present Value	(3)(4)
203 / 204	4	LCAM Channel 6 Present Value	(3)(4)
205 / 206	4	LCAM Channel 7 Present Value	(3)(4)
207 / 208	4	LCAM Channel 8 Present Value	(3)(4)
209 /210	4	Winding 1 - Expended Life, Loss of Insulation Life	(3) - CT series only
211 /212	4	Winding 2 - Expended Life, Loss of Insulation Life	(3) - CT series only
213 /214	4	Winding 3 - Expended Life, Loss of Insulation Life	(3) - CT series only
215 /216	4	Winding 1 - Remaining Life, Loss of Insulation Life	(3) - CT series only
217 /218	4	Winding 2 - Remaining Life, Loss of Insulation Life	(3) - CT series only
219 /220	4	Winding 3 - Remaining Life, Loss of Insulation Life	(3) - CT series only

3.2) Holding Registers (Read / Write - MODBUS Functions 03 / 06):

Register Number(s)	Size (bytes)	Advantage Data Name	Notes
0 - 2	6	Current Date/Time	(1)
3 - 9	-	None	Free
10	2	Alarm 1 Setpoint	(5)
11	2	Alarm 1 Hysteresis	(5)
12	2	Alarm 1 Operated Relay	(6)
13	2	Alarm 2 Setpoint	(5)
14	2	Alarm 2 Hysteresis	(5)
15	2	Alarm 2 Operated Relay	(6)
16	2	Alarm 3 Setpoint	(5)
17	2	Alarm 3 Hysteresis	(5)
18	2	Alarm 3 Operated Relay	(6)
19	2	Alarm 4 Setpoint	(5)
20	2	Alarm 4 Hysteresis	(5)
21	2	Alarm 4 Operated Relay	(6)
22	2	Alarm 5 Setpoint	(5)
23	2	Alarm 5 Hysteresis	(5)
24	2	Alarm 5 Operated Relay	(6)
25	2	Alarm 6 Setpoint	(5)
26	2	Alarm 6 Hysteresis	(5)
27	2	Alarm 6 Operated Relay	(6)
28	2	Alarm 7 Setpoint	(5)
29	2	Alarm 7 Hysteresis	(5)
30	2	Alarm 7 Operated Relay	(6)
31	2	Alarm 8 Setpoint	(5)
32	2	Alarm 8 Hysteresis	(5)
33	2	Alarm 8 Operated Relay	(6)
34	2	Alarm 9 Setpoint	(5)
35	2	Alarm 9 Hysteresis	(5)
36	2	Alarm 9 Operated Relay	(6)
37	2	Alarm 10 Setpoint	(5)
38	2	Alarm 10 Hysteresis	(5)

Register Number(s)	Size (bytes)	Advantage Data Name	Notes
39	2	Alarm 10 Operated Relay	(6)
40	2	Alarm 11 Setpoint	(5)
41	2	Alarm 11 Hysteresis	(5)
42	2	Alarm 11 Operated Relay	(6)
43	2	Alarm 12 Setpoint	(5)
44	2	Alarm 12 Hysteresis	(5)
45	2	Alarm 12 Operated Relay	(6)
46	2	Alarm 13 Setpoint	(5)
47	2	Alarm 13 Hysteresis	(5)
48	2	Alarm 13 Operated Relay	(6)
49	2	Alarm 14 Setpoint	(5)
50	2	Alarm 14 Hysteresis	(5)
51	2	Alarm 14 Operated Relay	(6)
52	2	Alarm 15 Setpoint	(5)
53	2	Alarm 15 Hysteresis	(5)
54	2	Alarm 15 Operated Relay	(6)
55	2	Alarm 16 Setpoint	(5)
56	2	Alarm 16 Hysteresis	(5)
57	2	Alarm 16 Operated Relay	(6)
58	2	Alarm 17 Setpoint	(5)
59	2	Alarm 17 Hysteresis	(5)
60	2	Alarm 17 Operated Relay	(6)
61	2	Alarm 18 Setpoint	(5)
62	2	Alarm 18 Hysteresis	(5)
63	2	Alarm 18 Operated Relay	(6)
64	2	Alarm 19 Setpoint	(5)
65	2	Alarm 19 Hysteresis	(5)
66	2	Alarm 19 Operated Relay	(6)
67	2	Alarm 20 Setpoint	(5)
68	2	Alarm 20 Hysteresis	(5)
69	2	Alarm 20 Operated Relay	(6)
70	2	Alarm 21 Setpoint	(5)

Register Number(s)	Size (bytes)	Advantage Data Name	Notes
71	2	Alarm 21 Hysteresis	(5)
72	2	Alarm 21 Operated Relay	(6)
73	2	Alarm 22 Setpoint	(5)
74	2	Alarm 22 Hysteresis	(5)
75	2	Alarm 22 Operated Relay	(6)
76	2	Alarm 23 Setpoint	(5)
77	2	Alarm 23 Hysteresis	(5)
78	2	Alarm 23 Operated Relay	(6)
79	2	Alarm 24 Setpoint	(5)
80	2	Alarm 24 Hysteresis	(5)
81	2	Alarm 24 Operated Relay	(6)
82 - 99	-	None	Free
100	2	Relay 1 Remote Control Function	(7)
101	2	Relay 2 Remote Control Function	(7)
102	2	Relay 3 Remote Control Function	(7)
103	2	Relay 4 Remote Control Function	(7)
104	2	Relay 5 Remote Control Function	(7)
105	2	Relay 6 Remote Control Function	(7)
106	2	Relay 7 Remote Control Function	(7)
107	2	Relay 8 Remote Control Function	(7)
108	2	Relay 9 Remote Control Function	(7)
109	2	Relay 10 Remote Control Function	(7)
110	2	Relay 11 Remote Control Function	(7)
111	2	Relay 12 Remote Control Function	(7)

3.3) Discrete Inputs Registers (Read Only - MODBUS Function 02):

Register Number(s)	Size (bits)	Advantage Data Name	Notes
0	1	Alarm 1 Status	0 => Not Alarmed 1 => Alarmed
1	1	Alarm 2 Status	
2	1	Alarm 3 Status	
3	1	Alarm 4 Status	
4	1	Alarm 5 Status	
5	1	Alarm 6 Status	
6	1	Alarm 7 Status	
7	1	Alarm 8 Status	
8	1	Alarm 9 Status	
9	1	Alarm 10 Status	
10	1	Alarm 11 Status	
11	1	Alarm 12 Status	
12	1	Alarm 13 Status	
13	1	Alarm 14 Status	
14	1	Alarm 15 Status	
15	1	Alarm 16 Status	
16	1	Alarm 17 Status	
17	1	Alarm 18 Status	
18	1	Alarm 19 Status	
19	1	Alarm 20 Status	
20	1	Alarm 21 Status	
21	1	Alarm 22 Status	
22	1	Alarm 23 Status	
23	1	Alarm 24 Status	
24 - 31	-	None	Free
32	1	LCAM 1 Alarm Status	0 => Not Alarmed 1 => Alarmed
33	1	LCAM 2 Alarm Status	
34	1	LCAM 3 Alarm Status	
35	1	LCAM 4 Alarm Status	
36	1	LCAM 5 Alarm Status	
37	1	LCAM 6 Alarm Status	
38	1	LCAM 7 Alarm Status	
39	1	LCAM 8 Alarm Status	
40 - 47	-	None	Free

Register Number(s)	Size (bits)	Advantage Data Name	Notes
48	1	Relay 1 Coil State	0 => De-energized 1 => Energized
49	1	Relay 2 Coil State	
50	1	Relay 3 Coil State	
51	1	Relay 4 Coil State	
52	1	Relay 5 Coil State	
53	1	Relay 6 Coil State	
54	1	Relay 7 Coil State	
55	1	Relay 8 Coil State	
56	1	Relay 9 Coil State	
57	1	Relay 10 Coil State	
58	1	Relay 11 Coil State	
59	1	Relay 12 Coil State	
60 - 79	-	None	Free
80	1	Relay 1 Coil Normal State	0 => De-energized 1 => Energized
81	1	Relay 2 Coil Normal State	
82	1	Relay 3 Coil Normal State	
83	1	Relay 4 Coil Normal State	
84	1	Relay 5 Coil Normal State	
85	1	Relay 6 Coil Normal State	
86	1	Relay 7 Coil Normal State	
87	1	Relay 8 Coil Normal State	
88	1	Relay 9 Coil Normal State	
89	1	Relay 10 Coil Normal State	
90	1	Relay 11 Coil Normal State	
91	1	Relay 12 Coil Normal State	
92 - 107	-	None	Free

NOTES

(1) Date/Time structure

It uses three consecutive registers to report or set a date/time value:

Register		**Register + 1**		**Register + 2**	
High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte
Year	Month	Day	Hour	Minute	Second
0 - 255	1 - 12	1 - 31	0 - 23	0 - 59	0 - 59

Add 2000 to the value of a reported Year.
Subtract 2000 from Year values, before writing to a register.

(2) Temperature Reading values

All temperature sources will report their current values with a 16 bit signed register.
If reading is available, reported value will be [temperature x 10].
If reading is not available (as if requesting RTD channel 2 on a SC model), reported value will be -10000.
If RTD sensor for temperature source is reporting a failure, reported value will be 8888 or -8888.

(3) High/Low values

It uses two consecutive register to report a 32 bits signed value. Evaluation of value should only be performed as a 32 bits signed register.

Register	**Register + 1**
High Word	Low Word

(4) LCAM Readings

If channel is configured as VOLTS AC or VOLTS DC, reading is given in [Volts x 100].
If channel is configured as AMPS DC, reading is given in microamps.
If channel is configured as AMPS AC, reading is given in [Amps x 10].
If channel is configured as DRY CONTACT, the High Word reading will be [0] for closed contact and [1] for an opened contact. The Low Word reading is given in [Volts x 100] and reports the voltage across the LCAM input.
If reading is not available (as if requesting a disabled or nonexistent channel, or a channel configured as Winding Current), reported value will be -10000.

(5) Alarm Setpoint and Hysteresis

For temperature sources Setpoint or Hysteresis, write the [desired value x 10]. When reading, it will report [current setting x 10].
For current sources Setpoint, write the [desired value / 10]. When reading, it will report [current setting / 10].
For current sources Hysteresis, write the [desired value]. When reading, it will report [current setting].

(6) Alarm operated relay

Register Value	**Function when writing**	**Function when reading**
-10000 (0xD8F0)	Disable alarm	Alarm disabled
0	Enable alarm, with no operated relay	Alarm enabled. No operated relay selected
1 - 12	Enable alarm, operating relay [1 - 12]	Alarm enabled, operating relay [1 - 12]

(7) Relay Remote control

Register Value (HEX)	Function when writing	Function when reading
0x0000	Return to local control	Remote control OFF - Local control ON
0x0001 - 0x7FFE	Set Pulse ON time, in seconds	Remaining Pulse ON time, in seconds
0x7FFF	Latch ON	Remote control ON - Latched ON
0x8001 -0xFFFE	Set Pulse OFF time, in seconds (time is set value - 0x8000)	Remaining Pulse OFF time, in seconds (time is read value - 0x8000)
0xFFFF	Latch OFF	Remote control ON - Latched OFF