Application Note   AN-VTC- 39

Optidrive VTC Modbus RTU Register Map

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General

This document details the Modbus RTU memory mapping implemented in Optidrive VTC drives, detailing which addresses are used to read and write data to / from Optidrives in a Modbus RTU network.
Optidrive VTC supports Modbus RTU as standard, including access to all parameters.

The following parameters should be set correctly when using Modbus :

> P1-12 (usually set to 4 for Modbus support) **
> P2-26 (communication baud rate)
> P2-27 (drive address)

** Note that if P1-12 = 0, 1, 2 or 3, the drive can still be monitored and parameters can be modified via Modbus, but control of the drive is not possible unless P1-12 = 4.

See User Guide for more information on these parameter settings

The Fieldbus Gateways (Profibus, DeviceNet) also use the Modbus interface. In this case, the baud rate must be set to 57kbps. For more information regarding the fieldbus gateway, please contact Invertek Drives Ltd, or visit our web site: www.invertek.co.uk

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Specification

The following table highlights the specification for the Modbus RTU implementation in Optidrive VTC

Protocol	Modbus RTU
Error check	CRC
Baud rate	9600bps, 19200bps, 38400bps, 57600bps, 115200bps (default)
Data format	**1 start bit, 8 data bits, 1 stop bits, no parity.**
Physical signal	RS 485 (2-wire)
User interface	RJ11 (see user guide for more information)

Memory Map

Table 1: Control and status registers

Register	Upper byte	Lower Byte	Command	Type
1*	Command		03,06	R/W
2*	Speed reference		03,06	R/W
3*	*Reserved*		03	R
4*	Acc ramp time	Dec ramp time	03,06	R/W
5	*Reserved*		03	R
6*	Error code	Drive status	03	R
7*	Motor speed		03	R
8*	Motor current		03	R
9*	Motor power		03	R
10	*Reserved*		03	R
11	Digital input status		03	R
12**	Rating ID		03	R
13**	Power rating		03	R
14**	Voltage rating		03	R
15**	Software version		03	R

* Registers are available in standard fieldbus gateway configuration
** Registers are only available with drive firmware revision V2.21 or later

Register Description

Read and write register

Register 1: Drive command

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Reserved													2nd	CMD	

Bit0, 1: Drive command setup: 00-stop, 01-start, 10-reset
Bit 2: 2nd deceleration ramp select flag

Register 2: speed reference setup

This register holds the speed reference value with one decimal place (200 = 20.0Hz). The maximum speed reference value is limited by P1-01.

Register 3: Reserved

This register is reserved

Register 4: Acc/Dec ramp setup

This register specifies the drive acceleration and deceleration ramp time.
High byte gives Accel ramp time in second: 25 = 25s, maximum 255.
Low byte gives Dec ramp time in second: 66 = 66s, maximum 255.
Note that if Accel ramp equals to zero, the register value will be ignored.

Read only registers

Register 6: Drive status and error code

High byte gives drive error code. (Valid when drive tripped, see appendix for details)

Low byte gives drive status (0: drive stopped, 1: drive running, 2: drive tipped)
Register 7: Motor speed information

This register gives motor speed information. The data is in Hz and with one decimal place (i.e. 234 = 23.4Hz)

Register 8: Motor current

This register gives motor current information. The data is in Amps within one decimal place (i.e. 87 = 8.7A)

Register 9: Reserved

This register is reserved

Register 10: Motor power

This register gives motor power information, the data includes two decimal place. The data unit depends on drive type. (i.e.124 = 1.24 KW/HP)

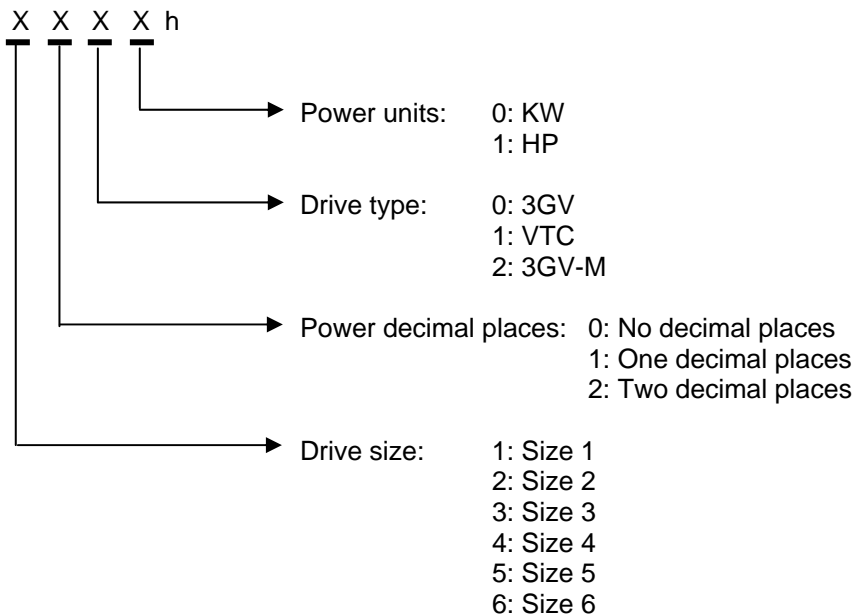Register 11: Digital input status

The value in this register represents the drive terminal digital input status (Digital input 1 to 4). Lowest bit indicates digital input 1 status.

Register 12: Rating ID

This register gives the following information:
Drive size, drive type, Power units and Power value decimal places

Register value (16 bits HEX format):

X X X X h

Power units: 0: KW
                1: HP

Drive type: 0: 3GV
                1: VTC
                2: 3GV-M

Power decimal places: 0: No decimal places
                        1: One decimal places
                        2: Two decimal places

Drive size: 1: Size 1
                2: Size 2
                3: Size 3
                4: Size 4
                5: Size 5
                6: Size 6

Note: Power decimal places is used for register 13 (Power rating). For example, if we have value x1x0h in register 12 and value 15 in register 13, this gives the drive power as 1.5KW. If we have value x0x0h in register 12 and same value 15 in register 13, this gives drive power as 15KW. Or if we have x1x1h in register 12 and 5 in register 13, then the drive power rating is 0.5HP. If we have x0x1h in register 12 and 5 in register 13, this gives drive power rating as 5HP.

Register 13: Power rating

Combine with the value in register 12, it gives the drive power rating information

Register 14: Voltage level

This register gives the rated input voltage level for the drive.

i.e. 230 : 230V   400: 400V   460: 460V

Register 15: Software version

This register contains the drive software version info. Value includes two decimal places.
i.e. 220 means version 2.20

Table 2: Monitor value registers
(Read only register with command 03)

Adr	Description	Data format
21	Bipolar analog input value	One decimal place 156=15.6%
22	2nd analog input value	One decimal place 156=15.6%
23	Speed control reference	156=156%
24	Digital speed reference	Internal value
25	Reserved	
26	User PID reference	One decimal place 156=15.6%
27	User PID feedback	One decimal place 156=15.6%
28	User PID error input	One decimal place 156=15.6%
29	User PID P term output	One decimal place 156=15.6%
30	User PID I term output	One decimal place 156=15.6%
31	User PID D term output	One decimal place 156=15.6%
32	User PID Output	One decimal place 156=15.6%
33	Reserved	
34	Magnetizing current	One decimal place 156=15.6A
35	Reserved	
36	Field strength	One decimal place 156=15.6%
37	Stator resistance	Three decimal place 156=0.156ohm
38	Reserved	
39	Reserved	
40	DC bus voltage	256 = 256V
41	Drive temperature	23 = 23 ^{0}C
42	Supply voltage L1	230 = 230V
43	Supply voltage L2	230 = 230V
44	Supply voltage L3	230 = 230V
45	Reserved	
46	Kwh meter	One decimal place 156=15.6Kwh
47	Mwh meter	156=156Mwh

Table 3: Parameter registers
(support command 03 and 06)

Adr	Description	Data range	Data format
129*	Max speed limit	0 to 7200	Internal value
130*	Min speed limit	0 to 7200	Internal value
131	Accel ramp time	0 to 30000	One decimal place 300=30.0s
132	Decel ramp time	0 to 30000	One decimal place 300=30.0s
133	Stop mode select	0 to 2	0: Ramp to stop 1: Coast to stop 2: Ramp to stop
134	Energy save	0 ,1	0: Disable 1: Enable
135	Motor rated voltage	20 to 250 (Low) 20 to 500 (High)	
136	Motor rated current	Drive dependent	One decimal place 300=30.0A
137	Motor rated frequency	25 to 2000	Data unit in Hz
138*	Motor rated speed	0 to 60000	Data unit in RPM
139	Preset speed 1	-P1-01 to P1-01	Internal value
140	Control mode	0 to 4	0: Terminal 1: Keypad forward only 2: Keypad forward and reverse 3: PID control mode 4: Modbus control mode
141	Trip log		Last four trips (See Appendix for details)
142	Access code	0 to 30000	
143	Digital inputs function	0 to 21	See user guide for function details
144*	Preset speed 2	-P1-01 to P1-01	Internal value
145*	Preset speed 3	-P1-01 to P1-01	Internal value
146*	Preset speed 4	-P1-01 to P1-01	Internal value
147*	Preset speed 5	-P1-01 to P1-01	Internal value
148*	Preset speed 6	-P1-01 to P1-01	Internal value
149*	Preset speed 7	-P1-01 to P1-01	Internal value
150*	Preset speed 8	-P1-01 to P1-01	Internal value
151*	Skip frequency 1	-P1-01 to P1-01	Internal value
152*	Skip freq band 1	P1-02 to P1-01	Internal value
153	Analog output function	0 to 9	See user guide for function details
154	Digital output ctrl limit (h)	0 to 100	Located in lower byte
	Digital output ctrl limit (L)	0 to high limit	Located in higher byte
155	Relay output function	0 to 6	See user guide for function details
156	Relay control limit (h)	0 to 100	Located in lower byte
	Relay control limit (L)	0 to high limit	Located in higher byte
157	Relay output mode	0 to 1	0: Normally open 1: Normally closed
158	Reserved	Read only	Read as zero
159	Start mode select	0 to 6	0: Edgr-r 1: Auto_0 2…6: Auto_1 to Auto_5
160	Spin start enable (V/F mode only)	0 or 1	

Adr	Description	Data range	Data format
161	Keypad restart mode	0 to 3	See user guide for details
162	Enable standby	0 to 60	Data unit in second (s)
163	Display scaling factor	0 to 30000	Three decimal place 300=0.3.00
164	Display scaling source	0 to 1	0: 2nd analog input 1: Drive speed
165	Brake circuit enable	0 to 3	See user guide for function details
166	Effective switching freq.	0 to 4 and it is drive dependent	0 = 4KHz, 1 = 8KHz, 2 = 16KHz 3 = 24KHz, 4 = 32KHz
167	2nd Decel ramp time (s)	0 to 30000	One decimal place 300=30.0s
168	Modbus baudrate	0 to 4	0 = 9600bps 1 = 19200bps 2 = 38400bps 3 = 57600bps 4 = 115200bps
169	Drive comms address	1 to 63	
170	Master/Slave mode	0 to 1	This is for Optibus application only, not for Modbus.
171	Speed scaling factor	0 to 5000	One decimal place 300=30.0%
172	Bipolar an input format	0 to 3	0: 0..24V 1: 0..10V 2: -10..10V 3: -24V..24V
173	Bipolar an input scaling	0 to 500	One decimal place 300=30.0%
174	Bipolar an input offset	0 to 1000	One decimal place 300=30.0%
175	2nd an input format	0 to 3	0: 0/24V Digital 1: 0..10V 2: 4..20mA 3: 0..20mA
176	2nd an input scaling	0 to 500	One decimal place 300=30.0%
177	Ditial speed reference scaling control	0 to 3	See user guide for function details
178	Analog output format	0 or 3	0: 0..10V 1: 4..20mA 2: 10..0V 3: 20..4mA
179	Extended access code	0 to 9999	
180	Parameter lock	0 or 1	0: Unlock 1: Locked
181	Reserved	Read only	Read as zero
182	Reserved	Read only	Read as zero
183	User PID P-Gain	1 to 300	One decimal place 200=20.0
184	User PID integral time constant	1 to 300	One decimal place 200=20.0s
185	Differential time constant	0 to 100	Two decimal place 20=0.20s
186	User PID operating mode	0 or 1	0: Direct mode 1: Inverse mode
187	User PID reference select	0 or 1	0: digital 1: Bi-polar analog input
188	User PID digital ref	0 to 1000	One decimal place 300=30.0%
189	User PID output high limit	0 to 100	No decimal place 100=100%
190	User PID output low limit	0 to 100	No decimal place 100=100%
191	PID output limit control	0 to 3	See user guide for function details
192	User PID feedback select	0 to 1	0: 2nd analog input 1: Bipolar analog input

Adr	Description	Data range	Data format
193	Reserved	*Read only*	*Read as zero*
194	Reserved	*Read only*	*Read as zero*
195	Reserved	*Read only*	*Read as zero*
196	Reserved	*Read only*	*Read as zero*
197	Reserved	*Read only*	*Read as zero*
198	Reserved	*Read only*	*Read as zero*
199	Reserved	*Read only*	*Read as zero*
200	RS auto measurement	0 or 1	
201	Reserved	*Read only*	*Read as zero*
202	Reserved	*Read only*	*Read as zero*
203	Reserved	*Read only*	*Read as zero*
204	Reserved	*Read only*	*Read as zero*
205	Reserved	*Read only*	*Read as zero*
206	Reserved	*Read only*	*Read as zero*
207	Reserved	*Read only*	*Read as zero*
208	Reserved	*Read only*	*Read as zero*

* Explanation for internal value:

For some speed related parameters, the drive uses an internal value instead of the actual speed in Hz in order to increase the resolution. For these speed related parameters, the internal value instead of the display value must be used in order to set the parameter correctly.

*Speed Internal = Speed in Hz * Factor*

When P1-09 < =100Hz,   Factor = 60.   ie 30.5Hz => 1830
When P1-09 > 100Hz,   Factor = 30.   ie 30.5Hz => 915

Appendix

Drive error code information:

0x00   No trip
0x01   Brake circuit over current (short circuit)
0x02   Over current
0x03   External trip
0x04   DC bus over voltage trip
0x05   DC bus under voltage trip
0x06   Over temperature trip
0x07   Under temperature trip
0x08   Spin start fault
0x09   Parameter defaut
0x0A   I*t trip (Over load trip)
0x0B   Phase imbalance trip
0x0C   Brake resister over load
0x0D   Power stage trip
0x0E   Communication link loss trip
0x0F   Phase loss trip
0x10   Thermistor fault
0x11   Auto-tune fault

Dataflow example:

Modbus RTU Read data from register 6 request :

Request: [01]   [03]   [00] [05]   [00] [01]   [94] [0B]
          (Drive Addr)   (Command)   (Reg start addr)   (No. of Registers)
(Checksum)

Reply: [01]   [03]   [02]   [00] [00]   [B8] [44]
          (Drive Addr)   (Command)   (No of data bytes)   (Data)
          (Checksum)

Note that the actual start address of register 6 is 5.

--- End ---