Cito Modbus-Communication

The Modbus-Communication is implemented as point to point communication channel between a host (e.q. standard PC) and the cito, configured as a slave.
For communication via this channel there is a protocol implemented, based on standard from the Modbus organisation (www.modbus.org).
The main differences are as follows:

- Using function codes to transfer the actual intend of the communication to the cito (e.q. reading or writing a register)
- All registers to be read or written are 32 bit registers
- Implemented additional exception codes

Connector and Pin Descriptions

The connector is located on the rear side of the cito. It is a serial RS 232 port carried out as a 9-pin, female, subminiature-D connector. The cito RxD has to be connected to the TxD of the host and the TxD to the RxD.

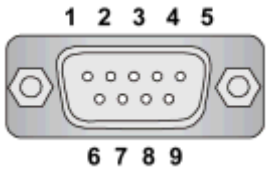

Figure 1: RS-232 connector located on cito rear side.

Table 1: RS-232 pin description

Signal / Pin	Name	Description
1	n. c.	-
2	TxD	Transmit data
3	RxD	Receive data
4	n. c.	-
5	Com / Gnd	Data common
6	n. c.	-
7	n. c.	-
8	n. c.	-
9	n. c.	-

Parameter Settings

Default parameters:

- Bitrate: 115.200 bit/s
- Eight data bits
- One Stop bit
- No Parity
- No start bit
- Low order bytes are first transmitted

Protocol

The protocol is based on the Modbus-RTU (RTU: Remote Terminal Unit) specification from the Modbus organisation. The cito is always configured as slave, the connected PC as host.
All data is coded in pure binary. The protocol supports reading and writing of only one command number (register) at a time.

Communication cycle

The host computer starts a communication by sending a message packet including a function code which implies the format of the answer from the cito. The cito registers the end of a message packet when, after receiving the first message byte, a pause of at least 1,5 * time / sign[1] with no more incoming data occurs. Through this the timing depends on the used bitrate. Regarding the fixed bitrate of 115.200, the pause must be at least 78.12 µs. The same applies for the host, when the cito is transmitting data. An answer from the cito to the host will be send within 0 and 50 ms (timeout = 50 ms). If no package is being received by the host in this time period, some error on the communication channel is the most likely answer to this behaviour.
There is no message cue implemented in the cito. This concludes to the necessity for the host of waiting for the answer from the cito or the 50 ms timeout before transmitting a new message packet.

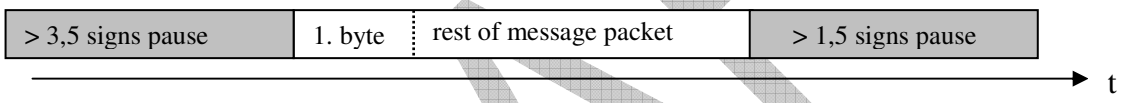

Figure 2:Ttiming for one message packet

Message packet from host to cito

A message packet consists of the following blocks:

- Header (3 bytes)
  - Address (1 byte)
  - Function code (1 byte)
- Command number (2 bytes)
- Data (1 to 249 bytes)
- CRC16 (2 bytes)

Header:
The header consists of a one byte address of the cito which is always fix (0x0A) and a one byte function code. The function codes can be separated into writing and reading functions.
Executing a writing function a value (or function) of the Cito can be set (or activated). Using a reading function the cito returns the requested value, e.q. the “forward power setpoint”.

Command number
The command number is a 2 byte number which defines the cito command/value to be set or red. It corresponds to the number in the “stolberg commander”.

Data

[1] 1 sign = 9 bits (8 data & one stopp bit)

The data block includes the data to be written to the cito or a fixed 2 byte answer, when a read function code is being used.
The length of the data block depends on the function code and the command number. It can be seen in following table. The length of the data being written to the cito will be checked in the cito itself regarding the min. / max. values.

Function code	read/write	Length of Data
0x42	Write	one to n bytes, depending on the command number
0x41	Read	Always 2 bytes: 0x0001

CRC16
The CRC16 checksum consists of two bytes and is based on the CRC-16-ANSI with a reversed representation (0xA001) of the polynomial $p(x) = x^{16} + x^{15} + x^2 + 1$
(also: http://en.wikipedia.org/wiki/Cyclic_redundancy_check).
The checksum must be build over the hole message packet excluding the CRC16 itself.

Cito answer to a host message packet

The cito answers in a maximum time period of 50 ms with a message packet which differs by the received function code. The answer includes the corresponding data to the answer itself or additional exception codes.

Answer to a read function code:
The answer packet to a read command consists of the following blocks:

- Header (3 bytes)
  - Address (1 byte)
  - Received function code (2 byte)
- Length (number of data bytes)
- Data (n bytes, max. 249)
- CRC16 (2 bytes)

If the length of the data and the data itself is being correct must be checked by the host itself.

Answer to a write function code:
The answer packet equals the send message packet by the host if a correct package is being transmitted and received (“Message packet from Host to Cito”).

Exception answer and codes

If an exception code occures the following exception answer will be send.

- Header (3 bytes)
  - Address (1 byte)
  - Exception function code (1 byte)
- Exception code (1 byte)
- CRC16 (2 bytes)

The exception function code is the received function code by the cito with the most significant bit set to one.

The exaption code can be as follows:

OK	0x00
Illigal function code	0x01
Illigal data adress	0x02
Illigal data value	0x03
Salve device failure	0x04
Slave device busy	0x06
Memory parity error	0x08
Device exeption	0x80

Sample implementation of CRC16

The following c-code sample implementation of the CRC16 calculation uses a pre calculated lookup table.

```
	static const WORD Crc16tab[256] =
	{
		0x0000, 0xC0C1, 0xC181, 0x0140, 0xC301, 0x03C0, 0x0280, 0xC241,
0xC601, 0x06C0, 0x0780, 0xC741, 0x0500, 0xC5C1,
		0xC481, 0x0440, 0xCC01, 0x0CC0, 0x0D80, 0xCD41, 0x0F00, 0xCFC1,
0xCE81, 0x0E40, 0x0A00, 0xCAC1, 0xCB81, 0x0B40,
		0xC901, 0x09C0, 0x0880, 0xC841, 0xD801, 0x18C0, 0x1980, 0xD941,
0x1B00, 0xDBC1, 0xDA81, 0x1A40, 0x1E00, 0xDEC1,
		0xDF81, 0x1F40, 0xDD01, 0x1DC0, 0x1C80, 0xDC41, 0x1400, 0xD4C1,
0xD581, 0x1540, 0xD701, 0x17C0, 0x1680, 0xD641,
		0xD201, 0x12C0, 0x1380, 0xD341, 0x1100, 0xD1C1, 0xD081, 0x1040,
0xF001, 0x30C0, 0x3180, 0xF141, 0x3300, 0xF3C1,
		0xF281, 0x3240, 0x3600, 0xF6C1, 0xF781, 0x3740, 0xF501, 0x35C0,
0x3480, 0xF441, 0x3C00, 0xFCC1, 0xFD81, 0x3D40,
		0xFF01, 0x3FC0, 0x3E80, 0xFE41, 0xFA01, 0x3AC0, 0x3B80, 0xFB41,
0x3900, 0xF9C1, 0xF881, 0x3840, 0x2800, 0xE8C1,
		0xE981, 0x2940, 0xEB01, 0x2BC0, 0x2A80, 0xEA41, 0xEE01, 0x2EC0,
0x2F80, 0xEF41, 0x2D00, 0xEDC1, 0xEC81, 0x2C40,
		0xE401, 0x24C0, 0x2580, 0xE541, 0x2700, 0xE7C1, 0xE681, 0x2640,
0x2200, 0xE2C1, 0xE381, 0x2340, 0xE101, 0x21C0,
		0x2080, 0xE041, 0xA001, 0x60C0, 0x6180, 0xA141, 0x6300, 0xA3C1,
0xA281, 0x6240, 0x6600, 0xA6C1, 0xA781, 0x6740,
		0xA501, 0x65C0, 0x6480, 0xA441, 0x6C00, 0xACC1, 0xAD81, 0x6D40,
0xAF01, 0x6FC0, 0x6E80, 0xAE41, 0xAA01, 0x6AC0,
		0x6B80, 0xAB41, 0x6900, 0xA9C1, 0xA881, 0x6840, 0x7800, 0xB8C1,
0xB981, 0x7940, 0xBB01, 0x7BC0, 0x7A80, 0xBA41,
		0xBE01, 0x7EC0, 0x7F80, 0xBF41, 0x7D00, 0xBDC1, 0xBC81, 0x7C40,
0xB401, 0x74C0, 0x7580, 0xB541, 0x7700, 0xB7C1,
		0xB681, 0x7640, 0x7200, 0xB2C1, 0xB381, 0x7340, 0xB101, 0x71C0,
0x7080, 0xB041, 0x5000, 0x90C1, 0x9181, 0x5140,
		0x9301, 0x53C0, 0x5280, 0x9241, 0x9601, 0x56C0, 0x5780, 0x9741,
0x5500, 0x95C1, 0x9481, 0x5440, 0x9C01, 0x5CC0,
		0x5D80, 0x9D41, 0x5F00, 0x9FC1, 0x9E81, 0x5E40, 0x5A00, 0x9AC1,
0x9B81, 0x5B40, 0x9901, 0x59C0, 0x5880, 0x9841,
		0x8801, 0x48C0, 0x4980, 0x8941, 0x4B00, 0x8BC1, 0x8A81, 0x4A40,
0x4E00, 0x8EC1, 0x8F81, 0x4F40, 0x8D01, 0x4DC0,
		0x4C80, 0x8C41, 0x4400, 0x84C1, 0x8581, 0x4540, 0x8701, 0x47C0,
0x4680, 0x8641, 0x8201, 0x42C0, 0x4380, 0x8341,
		0x4100, 0x81C1, 0x8081, 0x4040
	};

	//-----------------------------------------------------------------------
-----
	/**
		Sample implementation of the CRC16 calculation
*/
unsigned short crc16(
	const void *data,  ///< Array of bytes
	int bytes                              ///< Number of bytes in array
	)
{
		unsigned short crc = 0;
		int count;

		for ( count = 0; count < bytes; count++)
		{
```

```
                unsigned char tmp = (unsigned char)(crc ^ ((const
unsigned char*)data)[count]);
                crc = (unsigned short )((crc >> 8) ^ Crc16tab[tmp]);
            }

            return crc;
        }
```

Communication example

The following communication example shows the sent and received message packets
From the host to the cito (--- >) and from the cito to the host (<-OK--). The transmitted byte blocks are hexadecimal encoded (each byte separated by brackets) and do not include the two CRC16 bytes. The result is the interpreted result by the host.

	Read Label
------>	[0A][41][00][0A][00][01]
<-OK--	[0A][41][18][63][69][74][6F][20][31][33][31][30][20][23][36][34][30][30][30][30][31][30][30][30][31][00]
Result	cito 1310 #640000010001
	Read State
------>	[0A][41][1F][40][00][01]
<-OK--	[0A][41][04][00][00][00][01]
Result	1 (0x00000001)
	Read Power
------>	[0A][41][1F][55][00][01]
<-OK--	[0A][41][04][00][00][00][00]
Result	0 (0x00000000)
	RF on
------>	[0A][42][03][E9][00][00][00][01]
<-OK--	[0A][42][03][E9][00][00][00][01]
Result	OK
	RF off
------>	[0A][42][03][E9][00][00][00][00]
<-OK--	[0A][42][03][E9][00][00][00][00]
Result	OK

List of Command numbers

The following table shows the possible commands to be written or red from / to the cito.
Special value tables for some command numbers are given after listed after this table.

Command No	Parameter	Type	read/ write	Min	Max	Unit	example value
Device->Type							
10	Label	string	r				"cito 1310 #64000001xxxx"
11	Model	string	r				"cito"
12	Type	string	r				"1310"
13	Serial number	string	r				"64000001xxxx"
15	Nominal power	int (32 bit)	r			W	1000
16	Nominal frequency	int (32 bit)	r			kHz	13560
Device->Limits							
35	Max reflected power	int (32 bit)	r			W	200
41	Min frequency	int (32 bit)	r			kHz	13560
42	Max frequency	int (32 bit)	r			kHz	13560
Device->Analog / Digital Port->Analog Outputs							
3301	Analog output 1	int (32 bit)	r/w	value table Analog Output			RF Power
3302	Analog output 2	int (32 bit)	r/w	value table Analog Output			Reflected Power
3303	Analog output 3	int (32 bit)	r/w	value table Analog Output			DC Bias
3304	Analog output 4	int (32 bit)	r/w	value table Analog Output			Load Power
3305	Analog output 5	int (32 bit)	r/w	value table Analog Output			Matching Position 1
3306	Analog output 6	int (32 bit)	r/w	value table Analog Output			Matching Position 2
3307	Analog output 7	int (32 bit)	r/w	value table Analog Output			Off
3308	Analog output 8	int (32 bit)	r/w	value table Analog Output			Off
Device->Analog / Digital Port->Digital Outputs							
3401	Digital output 1	int (32 bit)	r/w	value table Digital Output			Ready status
3402	Digital output 2	int (32 bit)	r/w	value table Digital Output			Interlock satisfied
3403	Digital output 3	int (32 bit)	r/w	value table Digital Output			CEX locked
3404	Digital output 4	int (32 bit)	r/w	value table Digital Output			Setpoint warning
3405	Digital output 5	int (32 bit)	r/w	value table Digital Output			Error
3406	Digital output 6	int (32 bit)	r/w	value table Digital Output			Overtemp error
3407	Digital output 7	int (32 bit)	r/w	value table Digital Output			Matching active
3408	Digital output 8	int (32 bit)	r/w	value table Digital Output			Off
Device->Ethernet-							

>TCP/IP								
	5100	Current IP address	int (32 bit)	r			172.18.100.16	
	5101	IP address	int (32 bit)	r/w			0.0.0.0	
	5102	Net mask	int (32 bit)	r/w			0.0.0.0	
	5103	Gateway	int (32 bit)	r/w			0.0.0.0	
	5104	DNS	int (32 bit)	r/w			0.0.0.0	
	5105	Host Name	string	r/w	80 characters		""	
	5106	Domain Name	string	r/w	80 characters		""	
Device->Ethernet->UPnP								
	5801	UPnP mode	int (32 bit)	r/w	value table UPnP		Active	
Device->RS232->RS232 Parameter								
	6101	Protocol	int (32 bit)	r/w	value table Protocol		Modbus RTU	
	6102	Baud Rate	int (32 bit)	r/w	value table BdRate		115200 bps	
	6103	Data Bits	int (32 bit)	r/w	value table DataBits			8
	6104	Parity	int (32 bit)	r/w	value table Parity		Even	
	6105	Stop bits	int (32 bit)	r/w	value table StopBits			1
Device->System->Remote								
	7001	Sync bus	int (32 bit)	r/w	value table SyncBus		Off	
	7002	Control Source	int (32 bit)	r/w	value table ControlSrc		Each	
	7003	RFon/off source	int (32 bit)	r/w	value table ControlSrc		No override	
	7004	Setpoints source	int (32 bit)	r/w	value table ControlSrc		No override	
	7005	Matching source	int (32 bit)	r/w	value table ControlSrc		No override	
	7006	Settings source	int (32 bit)	r/w	value table ControlSrc		No override	
	7007	Control mode source	int (32 bit)	r/w	value table ControlSrc		No override	
Device->System->Time and Date								
	7101	Time	string	r/w			"00:03:29"	
	7102	Date	string	r/w			"1970-01-01"	
	7103	Set time	int (32 bit)	r/w	0	235959		329
	7104	Set date	int (32 bit)	r/w	19700100	20991200		19700101
	7105	Time format	int (32 bit)	r/w	value table TimeFormat		hh:mm:ss	
	7106	Date format	int (32 bit)	r/w	value table DateFormat		yyyy-mm-dd	
Device->System->Presets								
	7901	Load settings	int (32 bit)	r/w	value table LoadSetting			
	7902	Save settings	int (32 bit)	r/w	value table SaveSettings			
Device->Matching								
	25501	Type	string	r			""	
	25502	Model	string	r			""	

	25503	Serial	string	r				""
	25511	Power	int (32 bit)	r			W	0
	25512	Frequency	int (32 bit)	r			kHz	0
	25518	Firmware version	int (32 bit)	r				-0.01
Device->Version								
	501	cito version	string	r				"1.13a(MOD5270, build 3047, release)"
	590	User board	string	r				"shft standard I/O"
	595	Field bus board	string	r				"Fieldbus / agilo interface"
Control								
	1001	Command	int (32 bit)	r/w	value table Command			
Settings->Power Control								
	1201	Control mode	int (32 bit)	r/w	value table CtrlMode			Forward power
	1206	Power set point	int (32 bit)	r/w	0 (=0.000 W)	1000000 (=1000.000 W)	W	0
	1211	DC bias source	int (32 bit)	r/w	value table DC_Src			agilo
	1212	DC bias set point	int (32 bit)	r/w	0 (=0.000 V)	4000000 (=4000.000 V)	V	0
	1221	Process feedback source	int (32 bit)	r/w	value table Process_Src			agilo
	1222	Process set point	int (32 bit)	r/w	0 (=0.000 V)	4000000 (=4000.000 V)	V	0
	1225	Process feedback max	int (32 bit)	r/w	0 (=0.000 V)	20000000 (=20000.000 V)	V	4.000.000
	1226	Process feedback unit	int (32 bit)	r/w	value table Process_Unit			V
	1231	Gain factor	int (32 bit)	r/w	1 (=0.01)	10000 (=100.00)		1.00
	1232	Integral action factor	int (32 bit)	r/w	1 (=0.01)	10000 (=100.00)		1.00
Settings->CEX								
	1101	Frequency mode	int (32 bit)	r/w	value table FreqMode			Fixed
	1102	Frequency set point	int (32 bit)	r/w	13560000 (=13560.000 kHz)	13560000 (=13560.000 kHz)	kHz	13560
	1112	CEX phase shift	int (32 bit)	r/w	-360 Â°	360 Â°	Â°	0
	1113	Master RF phase	int (32 bit)	r/w	0 Â°	360 Â°	Â°	0
	1114	RF phase	int (32 bit)	r/w			Â°	0
Settings->Pulsing								
	1301	Pulse mode	int (32 bit)	r/w	value table PulseMode			Off
	1302	Pulse period	int (32 bit)	r/w	200 (=0.0200 ms)	600000000 (=60000.0000 ms)	ms	0.0333
	1303	Duty cycle	int (32 bit)	r/w	1 (=0.1 %)	999 (=99.9 %)	%	50.0
Settings->Slew Rate								

	1491	Rise time	int (32 bit)	r/w	0 (=0.000 s)	60000 (=60.000 s)	s	0.000	
	1492	Fall time	int (32 bit)	r/w	0 (=0.000 s)	60000 (=60.000 s)	s	0.000	
Settings->Recipe									
	1501	Recipe mode	int (32 bit)	r/w	value table Rec_Mode			Off	
	1502	On ramp time	int (32 bit)	r/w	0 (=0.000 s)	36000 (=36.000 s)	s	0.100	
	1503	Off ramp time	int (32 bit)	r/w	0 (=0.000 s)	36000 (=36.000 s)	s	0.100	
	1504	Intervals	int (32 bit)	r/w	1	10			1
	1505	Time 1	int (32 bit)	r/w	0 (=0.000 s)	3600000 (=3600.000 s)	s	0.100	
	1506	Power 1	int (32 bit)	r/w	0 (=0.000 W)	1000000 (=1000.000 W)	W		8
	1507	Time 2	int (32 bit)	r/w	0 (=0.000 s)	3600000 (=3600.000 s)	s	0.100	
	1508	Power 2	int (32 bit)	r/w	0 (=0.000 W)	1000000 (=1000.000 W)	W		8
	1509	Time 3	int (32 bit)	r/w	0 (=0.000 s)	3600000 (=3600.000 s)	s	0.100	
	1510	Power 3	int (32 bit)	r/w	0 (=0.000 W)	1000000 (=1000.000 W)	W		8
	1511	Time 4	int (32 bit)	r/w	0 (=0.000 s)	3600000 (=3600.000 s)	s	0.100	
	1512	Power 4	int (32 bit)	r/w	0 (=0.000 W)	1000000 (=1000.000 W)	W		8
	1513	Time 5	int (32 bit)	r/w	0 (=0.000 s)	3600000 (=3600.000 s)	s	0.100	
	1514	Power 5	int (32 bit)	r/w	0 (=0.000 W)	1000000 (=1000.000 W)	W		8
	1515	Time 6	int (32 bit)	r/w	0 (=0.000 s)	3600000 (=3600.000 s)	s	0.100	
	1516	Power 6	int (32 bit)	r/w	0 (=0.000 W)	1000000 (=1000.000 W)	W		8
	1517	Time 7	int (32 bit)	r/w	0 (=0.000 s)	3600000 (=3600.000 s)	s	0.100	
	1518	Power 7	int (32 bit)	r/w	0 (=0.000 W)	1000000 (=1000.000 W)	W		8
	1519	Time 8	int (32 bit)	r/w	0 (=0.000 s)	3600000 (=3600.000 s)	s	0.100	
	1520	Power 8	int (32 bit)	r/w	0 (=0.000 W)	1000000 (=1000.000 W)	W		8
	1521	Time 9	int (32 bit)	r/w	0 (=0.000 s)	3600000 (=3600.000 s)	s	0.100	
	1522	Power 9	int (32 bit)	r/w	0 (=0.000 W)	1000000	W		8

					(=1000.000 W)			
	1523	Time 10	int (32 bit)	r/w	0 (=0.000 s)	3600000 (=3600.000 s)	s	0.100
	1524	Power 10	int (32 bit)	r/w	0 (=0.000 W)	1000000 (=1000.000 W)	W	8
Settings->Load Limits								
	1701	RF on time	int (32 bit)	r/w	0 (=0.0 s)	36000 (=3600.0 s)	s	0.0
	1702	Forward power limit	int (32 bit)	r/w	0 (=0.000 W)	0 (=0.000 W)	W	1100
	1703	Reflected power limit	int (32 bit)	r/w	0 (=0.000 W)	0 (=0.000 W)	W	200
	1706	Reflected threshold	int (32 bit)	r/w	0 (=0.000 W)	0 (=0.000 W)	W	200
	1707	Reflected shutoff	int (32 bit)	r/w	0 (=0.0 s)	36000 (=3600.0 s)	s	0.0
	1710	Set point deviation	int (32 bit)	r/w	10 (=1.0 %)	500 (=50.0 %)	%	2.0
Settings->Matching								
	8201	Matching mode	int (32 bit)	r/w	value table Match_Mode			Auto
	8213	C load position	int (32 bit)	r/w			%	-0.1
	8214	C tune position	int (32 bit)	r/w			%	-0.1
	8203	C load ref. position	int (32 bit)	r/w	0 (=0.0 %)	1000 (=100.0 %)	%	5.0
	8204	C tune ref. position	int (32 bit)	r/w	0 (=0.0 %)	1000 (=100.0 %)	%	5.0
	8205	Min. position c load	int (32 bit)	r/w	0 (=0.0 %)	1000 (=100.0 %)	%	0.0
	8206	Max. position c load	int (32 bit)	r/w	0 (=0.0 %)	1000 (=100.0 %)	%	100.0
	8207	Min. position c tune	int (32 bit)	r/w	0 (=0.0 %)	1000 (=100.0 %)	%	0.0
	8208	Max. position c tune	int (32 bit)	r/w	0 (=0.0 %)	1000 (=100.0 %)	%	100.0
	8221	Matching error	int (32 bit)	r/w	value table Match_Err			Error
Actual Values->Control								
	8000	State	int (32 bit)	r				RF off
	8011	Frequency	int (32 bit)	r			kHz	13560
	8021	Forward power	int (32 bit)	r			W	0
	8022	Reflected power	int (32 bit)	r			W	0
	8023	Load power	int (32 bit)	r			W	0
	8041	CEX frequency	int (32 bit)	r			kHz	0
	8301	DC bias	int (32 bit)	r			V	0
	8302	External feedback	int (32 bit)	r			V	0
Actual Values->Errors								
	8100	Number of errors	int (32 bit)	r				0
	8101	Error 1	string	r				""
	8102	Error 1 state	int (32 bit)	r				
	8103	Error 2	string	r				""
	8104	Error 2 state	int (32 bit)	r				
	8105	Error 3	string	r				""

8106	Error 3 state	int (32 bit)	r		
8107	Error 4	string	r		""
8108	Error 4 state	int (32 bit)	r		
8109	Error 5	string	r		""
8110	Error 5 state	int (32 bit)	r		
8111	Error 6	string	r		""
8112	Error 6 state	int (32 bit)	r		
8113	Error 7	string	r		""
8114	Error 7 state	int (32 bit)	r		
8115	Error 8	string	r		""
8116	Error 8 state	int (32 bit)	r		
8117	Error 9	string	r		""
8118	Error 9 state	int (32 bit)	r		
8119	Error 10	string	r		""
8120	Error 10 state	int (32 bit)	r		
8121	Error 11	string	r		""
8122	Error 11 state	int (32 bit)	r		
8123	Error 12	string	r		""
8124	Error 12 state	int (32 bit)	r		
8125	Error 13	string	r		""
8126	Error 13 state	int (32 bit)	r		
8127	Error 14	string	r		""
8128	Error 14 state	int (32 bit)	r		
8129	Error 15	string	r		""
8130	Error 15 state	int (32 bit)	r		
8131	Error 16	string	r		""
8132	Error 16 state	int (32 bit)	r		
Actual Values->Warnings					
8150	Number of warnings	int (32 bit)	r		2
8151	Warning 1	string	r		""
8152	Warning 2	string	r		""
8153	Warning 3	string	r		""
8154	Warning 4	string	r		""
8155	Warning 5	string	r		""
8156	Warning 6	string	r		""
8157	Warning 7	string	r		""
8158	Warning 8	string	r		""
8159	Warning 9	string	r		""

8160	Warning 10	string	r			""
8161	Warning 11	string	r			""
8162	Warning 12	string	r			""
8163	Warning 13	string	r			""
8164	Warning 14	string	r			""
8165	Warning 15	string	r			""
8166	Warning 16	string	r			""
Actual Values->Matching						
9201	Matching state	int (32 bit)	r			No matching
9203	C load position	int (32 bit)	r		%	-0.1
9204	C tune position	int (32 bit)	r		%	-0.1
9205	C load	int (32 bit)	r		pF	-0.01
9206	C tune	int (32 bit)	r		pF	-0.01
9251	DC bias matching	int (32 bit)	r		V	0
Diagnostic->Actual Values						
20421	Fan 1 speed	int (32 bit)	r		rpm	2800
20422	Fan 2 speed	int (32 bit)	r		rpm	3720

value table Analog Output

"0">Off;Analog output off
"1">RF Power;RF Power Monitor
"2">Forward Power;Forward Power Monitor
"3">Reflected Power;Reflected Power Monitor
"4">Load Power;Load Power Monitor
"5">DC Bias;DC Bias Monitor
"9">Frequency;Frequency Monitor
"10">Matching Position 1;Matching Position 1
"11">Matching Position 2;Matching Position 2
"12">External Feedback;Process Feedback Monitor
"50">5V;Analog output 5V
"100">10V;Analog output 10V

value table Digital Output

"0">Off;Digital output off
"1">Ready status;Ready status
"2">Interlock satisfied;Interlock satisfied
"3">CEX locked;CEX locked
"5">Setpoint warning;Setpoint warning
"6">Error;Error
"7">Overtemp error;Overtemp error
"8">Matching active;Matching active
"9">Matching error;Matching error
"4">Warning;Warning
"100">On;Digital output on
"101">Not Ready status;Ready status inverted
"102">Not Interlock satisfied;Interlock satisfied inverted
"103">Not CEX locked;CEX locked inverted
"105">Not Setpoint warning;Setpoint warning inverted
"106">Not Error;Error inverted
"107">Not Overtemp error;Overtemp error inverted
"108">Not Matching active;Matching active inverted
"109">Not Matching error;Matching error inverted
"104">Not Warning;Warning inverted

value table UPnP

"0">Off;No UPnP
"1">Passive;No UPnP notify
"2">Active;Full UPnP features

value table Protocol

"0">Off;Protocol is off
"1">Modbus RTU;Protocol is Modbus RTU

value table BdRate

"2400">2400 bps;Baudrate 2400 bps
"4800">4800 bps;Baudrate 4800 bps
"9600">9600 bps;Baudrate 9600 bps
"19200">19200 bps;Baudrate 19200 bps
"38400">38400 bps;Baudrate 38400 bps
"57600">57600 bps;Baudrate 57600 bps
"115200">115200 bps;Baudrate 115200 bps

value table DataBits

"6103" "7">7;Data bits: 7
"6103" "8">8;Data bits: 8

value table Parity

"6104" "0">No;No parity
"6104" "1">Odd;Parity odd
"6104" "2">Even;Parity even

value table StopBits

"6105" "1">1;Stop bits: 1
"6105" "2">2;Stop bits: 2

value table SyncBus

"7001" "0">Off;System bus off
"7001" "1">Master;System bus master
"7001" "2">Slave;System bus slave

value table ControlSrc

"0">Each;Each interface except analog is in control
"1">Front Panel;Front Panel is in control
"2">Modbus-TCP;Modbus TCP is in control
"3">Modbus-RTU;Modbus RTU is in control
"4">Analog Port;Analog / digital port is in control

value table TimeFormat

"0">hh:mm:ss;hours:minutes:seconds e.g. 18:01:02
"1">12:mm:ss PM;hours:minutes:seconds AM or PM e.g. 06:01:02 PM
"2">hhmmss;hoursminutesseconds e.g. 180102
"3">PM 12:mm:ss;AM or PM hours:minutes:seconds e.g. PM 06:01:02

value table DateFormat

"0">yyyy-mm-dd;year-month-day e.g. 1999-12-31
"1">mm/dd/yyyy;month/day/year e.g. 12/31/1999
"2">dd/mm/yyyy;day/month/year e.g. 31/12/1999
"3">dd.mm.yyyy;day.month.year e.g. 31.12.1999

value table LoadSetting

"0">Default;Default preset
"1">Preset 1;Preset 1
"2">Preset 2;Preset 2
"3">Preset 3;Preset 3
"4">Preset 4;Preset 4
"5">Preset 5;Preset 5

value table SaveSettings

"1">Preset 1;Preset 1
"2">Preset 2;Preset 2
"3">Preset 3;Preset 3
"4">Preset 4;Preset 4
"5">Preset 5;Preset 5

value table Command

"0">RF off;Switch off RF
"1">RF on;Switch on RF
"9">Reset;Reset errors

value table CtrlMode

"0">Forward power;Set point is forwqard power
"1">Load power;Set point is load power
"2">DC Bias;Set point is DC Bias
"3">Process control;Set point is external feedback

value table DC_Src

"0">Off;Off
"11">agilo;agilo
"1">Analog 1;Analog input 1
"2">Analog 2;Analog input 2

"3">Analog 3;Analog input 3
"4">Analog 4;Analog input 4
"5">Analog 5;Analog input 5

value table Process_Src
"0">Off;Off
"11">agilo;agilo
"1">Analog 1;Analog input 1
"2">Analog 2;Analog input 2
"3">Analog 3;Analog input 3
"4">Analog 4;Analog input 4
"5">Analog 5;Analog input 5

value table Process_Unit
"0">;No unit
"1">W;Power in Watt
"2">V;Voltage in Volt
"3">A;Current in Ampere
"7">°C;Temperature in °C
"10">%;Percent
"13">kWh;Enegry in kWh

value table FreqMode
"0">Fixed;Frequency is fixed
"1">Fixed CEX Master;Frequency is fixed, CEX output activated
"10">CEX;Frequency is set by CEX
"11">CEX terminated;Frequency is set by CEX, CEX input termination activated

value table PulseMode
"0">Off;Continuous wave (cw) mode
"1">External;External pulsing by pulse input on user board
"2">Internal;Internal pulsing by internal pulse generator
"11">External inverted;External pulsing by inverted pulse input on user board

value table Rec_Mode
"0">Off;Recipe off
"1">RF on/off ramp;RF on/off ramp
"2">Power ramping;Power ramping

value table Match_Mode
"1">Manual;Manual matching mode
"2">Auto;Automatic matching mode

value table Match_Err
"0">Ignore;Ignore matching error
"1">Error;Issue error on matching error
"2">Time out + error;Issue error on time out and matching error