WELDING SONICATOR GENERATOR

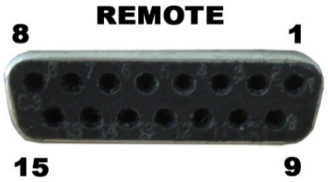
Protocol Description
RS485 ModBus RTU

CONTENTS

The generator supports standard RS485 ModBus RTU protocol. RS485 Bus is available by 25-pin DSUB I/O socket on the back side panel and through RJ45 connector on the front panel of the generator.

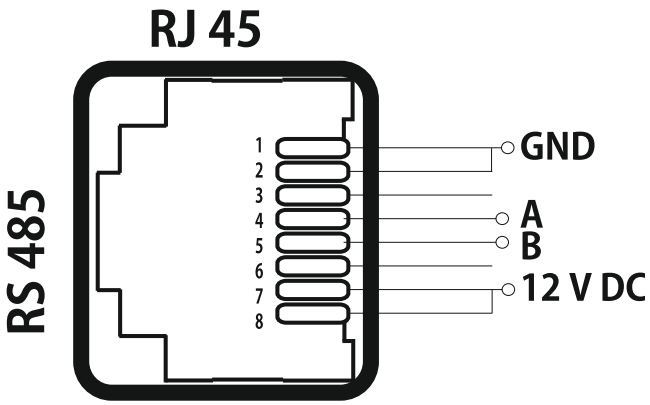
15-pin DSUB I/O socket

Assignment of the 15-pin DSUB interface socket



PIN No. on DSUB SOCKET Interface X1	Signal name	Description
1	+12 VOLT OUT	15 Volt for external use
2	POUT	Output 0 – 10 Volt = Power output 0 – 100 %
3	P-EXT.-IN	Input 0 – 10 Volt for power control
4	GND	Internal Ground for analog input and output internal (GND)
5/9	HF-DA-ERROR	Common sigmal for HF-DA-ERROR
6	HF-DA	Optocoupler output “HF-DA”
7	ERROR	Optocoupler output “ERROR”
8	A	ModBus over RS485 “A” signal
9/5	HF-DA-ERROR	Relay root (shared) for “HF-DA” and “ERROR”
10	B	ModBus over RS485 ”B” sigmal
11	Not connected	
12	Not connected	
13	FS-24 V	Remote START/STOP control input (with 10 – 24 Volt)
14	GND	internal (GND)
15	GND	internal (GND)

Interface socket RS485 ModBus - RJ 45 CONNECTOR:



PINS	DESCRIPTION
1	GND
2	GND
3	N/C
4	A
5	B
6	N/C
7	12 V DC
8	12 V DC

Bus Description

• bus address of the device (1 - 255) –selecting via LCD panel
• transmission speed – 57 600 bps
• No parity check
• The number of Data-Bits is RTU 8 Data-Bits
• The number of STOP-Bits is 1 STOP-Bit

Important remarks for operation in the Master/Slave-System:
!! The bus address must be differently adjusted for each device
!! Transmission mode, baud rate and parity must be identical

All data in a MODBUS-Slave are allocated to addresses. Data access (read or write) is made by the corresponding control command and the indication of the corresponding data address.
In general, a MODBUS telegram starts with the address of the slave, followed by a control command (e.g. read register) and the data. By means of the checksum at the telegram end, the bus participants can recognize transmission errors.

The following MODBUS – control commands are supported:

Description	**Function code**
Read Registers	0x03
Write Registers	0x10

Example:
Read Registers 3 (0x03)
Query

Field Name	Example
Slave Address	0x11
Function	0x03
Starting Address Hi	0x00
Starting Address Lo	0x6B
No. of Points Hi	0x00
No. of Points Lo	0x03
Error Check (CRC)	—

Response

Field Name	Example
Slave Address	0x11
Function	0x03
Byte Count	0x06
Data Hi	0x02
Data Lo	0x2B
Data Hi	0x00
Data Lo	0x00
Data Hi	0x00
Data Lo	0x64
Error Check (CRC)	—

Write Registers 16 (0x10)
Query

Field Name	Example
Slave Address	0x11
Function	0x10
Starting Address Hi	0x00

Starting Address Lo	0x01
No. of Registers Hi	0x00
No. of Registers Lo	0x02
Byte Count	0x04
Data Hi	0x00
Data Lo	0x0A
Data Hi	0x01
Data Lo	0x02
Error Check (CRC)	—

Response

Field Name	Example
Slave Address	11
Function	10
Starting Address Hi	00
Starting Address Lo	01
No. of Registers Hi	00
No. of Registers Lo	02
Error Check (CRC)	—

CRC Generation

A procedure for generating a CRC is:

1, Load a 16–bit register with FFFF hex (all 1's). Call this the CRC register.
2. Exclusive OR the first 8–bit byte of the message with the low–order byte of the 16–bit CRC register, putting the result in the CRC register.
3. Shift the CRC register one bit to the right (toward the LSB), zero–filling the MSB. Extract and examine the LSB.
4. (If the LSB was 0): Repeat Step 3 (another shift).
(If the LSB was 1): Exclusive OR the CRC register with the polynomial value A001 hex (1010 0000 0000 0001).
5. Repeat Steps 3 and 4 until 8 shifts have been performed. When this is done, a complete 8–bit byte will have been processed
When the 16–bit CRC (two 8–bit bytes) is transmitted in the message, the low-order byte will be transmitted first, followed by the high-order byte.

Registers Definition

MODBUS RS485 RTU no parity, 8 bit data, 1 stop bit						
register#	**address**	**action**	**parameter**	**dim/resolution**	**type**	**format**
0	0x0000	R/W	spare	ru	unsigned INT	
1	0x0001	R	Phase	ru	unsigned INT	
2	0x0002	R	Frequency	0.001 kHz	fixed point	XX.XX kHz
3	0x0003	R	Temperature	°C	unsigned INT	XX °C
4	0x0004	R	Amplitude	0.10%	fixed point	XXX.X %
5	0x0005	R	AV	%	fixed point	XXX.X %
6	0x0006	R	AV PWM	%	fixed point	XXX.X %
7	0x0007	R	Power	W	unsigned INT	
8	0x0008	R	Output Current	0.005 A	fixed point	X.XXX A
9	0x0009	R	Last peak power	W	unsigned INT	
10	0x000A	R	Last energy	Ws	unsigned INT	
11	0x000B	R	Last time	0,01 s	fixed point	X.XX s
12	0x000C	R	Sonicator Time	1 s	unsigned INT	
13	0x000D	R	Sonicator Time ON	1 s	unsigned INT	
14	0x000E	R	Sonicator Time OFF	1 s	unsigned INT	
15	0x000F	R	Sonicator Energy High	J	long INT high part	
16	0x0010	R	Sonicator Energy Low	J	long INT low part	
17	0x0011	R	Status	ASCII code	unsigned BYTE	0x30 STOP
						0x31 START
						0x32 Over Current
						0x33 Over Heat
						0x34 Over Voltage
						0x35 Limit Time
						0x36 Limit Power
						0x37 Limit Energy
						0x38 Untested
						0x39 Over Load
						0x3A HF Over Current
						0x3B External Overheat
18	0x0012	R/W	spare	ru	unsigned INT	
19	0x0013	R/W	spare	ru	unsigned INT	
20	0x0014	R/W	spare	ru	unsigned INT	
21	0x0015	R/W	spare	ru	unsigned INT	
22	0x0016	R/W	spare	ru	unsigned INT	

23	0x0017	R/W	spare	ru	unsigned INT	
		R/W	spare	ru	unsigned INT	
		R/W	spare	ru	unsigned INT	
24	0x0018	R/W	spare	ru	unsigned INT	
25	0x0019	R/W	spare	ru	unsigned INT	
26	0x001A	R/W	spare	ru	unsigned INT	
27	0x001B	R/W	spare	ru	unsigned INT	
28	0x001C	R/W	spare	ru	unsigned INT	
29	0x001D	W	Command Word	bit field	usigned BYTE	bit 0 - START
						bit 1 - STOP
						bit 2 - SCAN
						bit 3 - WRITE
						bit 4 - TUNE
30	0x001E	R/W	Phase	ru	usigned INT	
31	0x001F	R/W	Start frequency set point	0,001 kHz	fixed point	XX.XXX kHz
32	0x0020	R/W	Span	0,001 kHz	fixed point	X.XXX kHz
33	0x0021	R/W	Amplitude Set Point	0.10%	fixed point	XXX.X %
34	0x0022	R/W	Scanning Range	0,001 kHz	fixed point	X.XXX kHz
35	0x0023	R/W	Startup mode	ru	unsigned INT	0-Normal without Scan
						1 - Scanning only on Safe Start
						2 - Scanning every time
						3 - Hot Start
36	0x0024	R/W	Current Set Point	0.005 A	fixed point	X.XXX A
37	0x0025	R/W	spare	ru	unsigned INT	
38	0x0026	R/W	Mode	ru	unsigned INT	0 - Welding
						1 - Sonicator
39	0x0027	R/W	Sampling Time	s	unsigned INT	
40	0x0028	R/W	spare	ru	unsigned INT	
41	0x0029	R/W	spare	ru	unsigned INT	
42	0x002A	R/W	spare	ru	unsigned INT	
43	0x002B	R/W	spare	ru	unsigned INT	
44	0x002C	R/W	spare	ru	unsigned INT	
45	0x002D	R/W	spare	ru	unsigned INT	
46	0x002E	R/W	spare	ru	unsigned INT	
47	0x002F	R/W	spare	ru	unsigned INT	
48	0x0030	R/W	spare	ru	unsigned INT	
49	0x0031	W	Command Write	ru	unsigned INT	1 - write enable for parameters 30 - 39
50	0x0032	R/W	Peak Power	W	unsigned INT	
51	0x0033	R/W	Energy	Ws	unsigned INT	
52	0x0034	R/W	Time	0.01s	fixed point	X.XX s

53	0x0035	R/W	Peak Power Plus	1W	unsigned INT	
54	0x0036	R/W	Peak Power Minus	1W	unsigned INT	
55	0x0037	R/W	Energy Plus	1W	unsigned INT	
56	0x0038	R/W	Energy Minus	1W	unsigned INT	
57	0x0039	R/W	Time Plus	0.01s	fixed point	X.XX s
58	0x003A	R/W	Time Minus	0.01s	fixed point	X.XX s
59	0x003B	R/W	Amplitude Regulator	10 ru	unsigned INT	
60	0x003C	R/W	Phase Regulator	10 ru	unsigned INT	
61	0x003D	R/W	StartUp Regulator	10 ru	unsigned INT	
62	0x003E	R/W	Power Offset	1W	unsigned INT	
63	0x003F	R/W	Power Scale	0.01 ru	fixed point	X.XX
64	0x0040	R/W	Amplitude Scale	0.01 ru	fixed point	X.XX
65	0x0041	R/W	bit field	bit field	unsigned BYTE	bit 0 - Overload Protection Trip bit 1 - Overload Protection Warning bit 2 - Test Button Push bit 3 - Test Button Letch bit 4 - Analog Input Amplitude SetPoint bit 5 - Analog Input Transducer Temperature
66	0x0042	R/W	Amplitude Ramp	ru	unsigned INT	
67	0x0043	R/W	spare	ru	unsigned INT	
68	0x0044	R/W	spare	ru	unsigned INT	
69	0x0045	R/W	spare	ru	unsigned INT	
70	0x0046	R/W	Process Time High	s	long INT high part	
71	0x0047	R/W	Process Time Low	s	long INT low part	
72	0x0048	R/W	Time OFF	s	unsigned INT	
73	0x0049	R/W	Time ON	s	unsigned INT	
74	0x004A	R/W	Process Energy High	J	long INT high part	
75	0x004B	R/W	Process Energy Low	J	long INT low part	
76	0x004C	R/W	Input Voltage	ru	unsigned INT	1 - low 2 - middle 3 - high
77	0x004D	R/W	Output Choke	uh	unsigned INT	
78	0x004E	R/W	Output Capacitor	nF	unsigned INT	
79	0x004F	R/W	Extra Span	0.001 kHz	fixed point	X.XXX kHz
80	0x0050	R/W	PWM	%	unsigned INT	
81	0x0051	R/W	Sweeping	0.001 kHz	fixed point	X.XXX kHz
82	0x0052	R/W	Sweeping	0.1 Hz	fixed point	X.X Hz

			Frequency			
83	0x0053	R/W	Smoothing	0.01 ru	fixed point	X.XX
84	0x0054	R/W	FSWM Frequency	1 Hz	unsigned INT	
85	0x0055	R/W	FSWM Period	ru	unsigned INT	
86	0x0056	R/W	FSWM Ratio	%	unsigned INT	
87	0x0057	R/W	Mode Sweep	ru	unsigned INT	0 - continuous 1 - AMMM 2 - Periodic
…….						
500-699	0x01F4 - 0x02BB	R	Scanning DATA			
…….						

Registers 30 to 39 are always written together in one ModBus telegram, and in the same telegram there must also be permission for their recording in the generator's memory - in register 49 should be written "1".

Example of such telegram - set Amplitude:

Field Name	bytes	decimal	hex	PARAMETER
Slave Address	1	5	5	MODBUS HEADER
Function	1	16	10	MODBUS HEADER
Starting Address Hi	1	00	0	MODBUS HEADER
Starting Address Lo	1	30	1E	MODBUS HEADER
No. of Registers Hi	1	0	0	MODBUS HEADER
No. of Registers Lo	1	20	14	MODBUS HEADER
Byte Count	1	40	28	MODBUS HEADER
Data 1	2	326	146	PHASE
Data 2	2	20120	4E98	START FREQUENCY
Data 3	2	1000	3E8	SPAN
Data 4	2	795	31B	AMPLITUDE (SET TO 79.5%)
Data 4	2	1000	3E8	SCANING RANGE
Data 5	2	0	0	-
Data 6	2	338	152	CURRENT
Data 7	2	100	64	-
Data 8	2	0	0	MODE
Data 9	2	0	0	SAMLING TIME
Data 10	2	0	0	-
Data 11	2	0	0	-
Data 12	2	0	0	-
Data 13	2	0	0	-
Data 14	2	0	0	-
Data 15	2	0	0	-
Data 16	2	0	0	-
Data 17	2	0	0	-
Data 18	2	0	0	-
Data 19	2	0	0	-
Data 20	2	1	1	COMMAND WRITE
Error Check (CRC)	2	-	-	CRC16