SIEMENS

ATC5300
Automatic Transfer Controller

Modbus® Communication Protocol

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

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indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

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⚠ CAUTION

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CAUTION

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NOTICE

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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General Information

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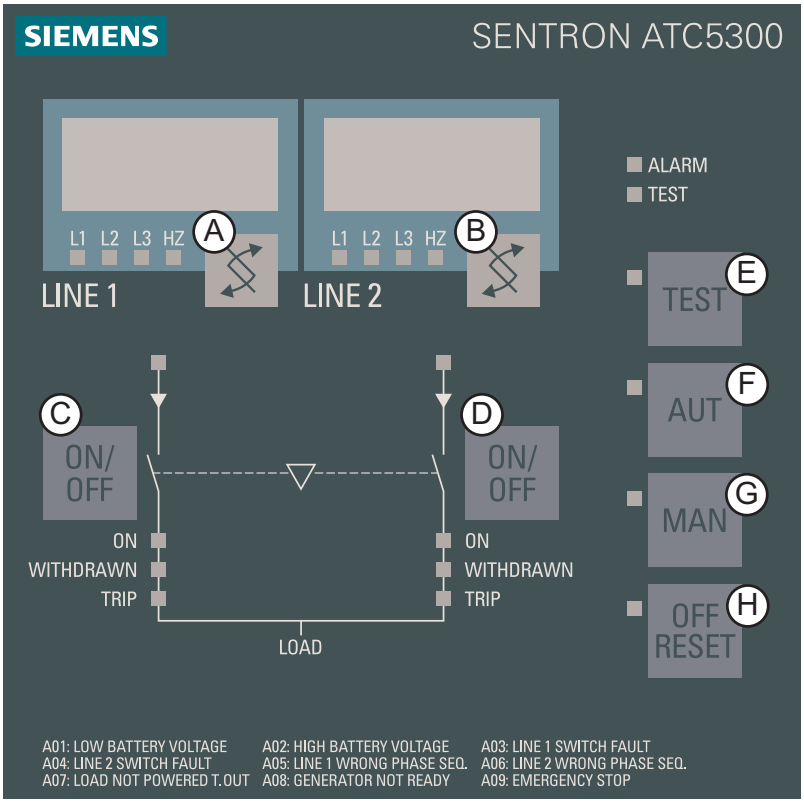
1.1 Modbus® Protocol

The ATC series of automatic transfer controllers support the communication protocols Modbus RTU® and Modbus ASCII® on the RS 232 and RS 485 serial ports. Using this function it is possible to read the device status and to control the units through the dedicated remote control software (SENTRON SOFTWARE ATC), third-party supervision software (SCADA) or through other intelligent devices supporting Modbus®, like PLCs.

1.2 Parameter Setting

To configure the Modbus® protocol, enter P7 menu – Serial communication using the following procedure:



- With the unit in OFF-RESET mode, press the **H** and **A** keys together for five consecutive seconds.
- The line 1 display will show the code of the first parameter. The first digit of the code is the menu number which blinks alternating with a P, while the two following digits indicate the number of the parameter within the menu. The first parameter is P1.01, i.e. menu P1, parameter 01.
- Press keys **A** or **C** to scroll the parameters of the same menu.
- Press keys **E** or **F** to browse the different menus.
- The digit identifying the parameter is shown on LINE 1 display, while the current setting is shown on LINE 2 display.
- Press keys **B** or **D** to change the setting of the selected parameter.
- By moving to another parameter or quitting, the menu the setting will be stored automatically.
- Press key **H** to quit parameters setup.
- If no keys are pressed for more than 2 minutes, the unit exits setup automatically without storing the changes.

1.3 Menu P7 - Serial Communication

PAR	Function	Range	Default
P7.01	RS 232 Address	1 …245	1
P7.02	RS 232 Baud Rate	2400 4800 9600 19200 38400	9600 baud
P7.03	RS 232 Protocol	Rtu ASC - ASCII Mod - ASCII + modem	rtu
P7.04	RS 232 Parity	Non - None Odd EvE - Even	non
P7.05 ①	RS 485 Baud Rate	1 …245	1
P7.06 ①	RS 485 Baud Rate	2400 4800 9600 19200 38400	9600 baud
P7.07 ①	RS 485 Protocol	Rtu ASC - ASCII Mod - ASCII + modem	rtu
P7.08 ①	RS 485 Parity	Non - None Odd EvE - Even	non

① Only for ATC5300

1.4 Modbus® RTU Protocol

If one selects the Modbus® RTU protocol, the communication message has the following structure:

T1 T2 T3	Address (8 bit)	Function (8 bit)	Data (N x 8 bit)	CRC (16 bit)	T1 T2 T3

- The Address field holds the serial address of the slave destination device.
- The Function field holds the code of the function that must be executed by the slave.
- The Data field contains data sent to the slave or data received from the slave in response to a query.
- For the ATC, the maximum length for the data field is of 60 16-bit registers (120 bytes).
- The CRC field allows the master and slave devices to check the message integrity. If a message has been corrupted by electrical noise or interference, the CRC field allows the devices to recognize the error and thereby to ignore the message.
- The T1 T2 T3 sequence corresponds to a time, in which data must not be exchanged on the communication bus to allow the connected devices to recognize the end of one message and the beginning of another. This time must be at least 3.5 times the time required to send one character.

The ATC measures the time that elapse from the reception of one character and the following. If this time exceeds the time necessary to send 3.5 characters at the selected baudrate, then the next character will be considered as the first of a new message.

1.5 Modbus® Functions

The available functions are:

04 = Read input register	Allows to read the ATC measures.
06 = Preset single register	Allows writing parameters.
07 = Read exception	Allows to read the device status.
10 = Preset multiple register	Allows writing several parameters.
17 = Report slave ID	Allows to read information about the ATC.

For instance, to read the value of the battery voltage, which resides at location 30 (1E Hex) from the ATC with serial address 01 the message to send is the following:

01	04	00	1D	00	02	E1	CD

Whereas:

01= slave address

04 = Modbus® function "Read input register"

00 1D = Address of the required register (battery voltage) decreased by one

00 02 = Number of registers to be read beginning from address 30

E1 CD = CRC Checksum

The ATC answer is the following:

01	04	04	00	00	00	7C	65

Where:

01 = ATC address (Slave 01)

04 = Function requested by the master

04 = Number of bytes sent by the ATC

00 00 00 7C = Hex value of the battery voltage = 124 = 12.4 VDC

FA 65 = CRC checksum

1.6 Function 04: Read Input Register

The Modbus® function 04 allows to read one or more consecutive registers from the slave memory. The address of each measure is given in the chapter "Data Library" of this manual. As for Modbus® standard, the address in the query message must be decreased by one from the effective address reported in the table. If the measure address is not included in the table or the number of requested registers exceeds 60, the ATC will return an error code (see error table).

Master query:

Slave address	08h
Function	04h
MSB address	00h
LSB address	0Fh
MSB register number	00h
LSB register number	08h
MSB CRC	21h
LSB CRC	57h

In the above example slave 08 is requested for 8 consecutive registers beginning with address 10h. Thus, registers from 10h to 17h will be returned. As usual, the message ends with the CRC checksum.

Slave response:

Slave address	08h
Function	04h
Byte number	10h
MSB register 10h	00h
LSB register 10h	00h
—	—
MSB register 17h	00h
LSB register 17h	00h
MSB CRC	5Eh
LSB CRC	83h

The response is always composed of the slave address, the function code requested by the master and the contents of the requested registers. The answer ends with the CRC.

1.7 Function 06: Preset Single Register

This function allows to write in the registers. It can be used only with registers with address higher than 1000 Hex. For instance it is possible to change setup parameters. If the value is not in the correct range, the ATC will answer with an error message. In the same way, if the parameter address is not recognised, the ATC will send an error response.

The address and the valid range for each parameter are indicated in Tables 5, 6 and 7. With function 06, some commands (like passing from MAN to AUT and vice versa) can be possibly executed sending the addresses and the values reported in Table 4.

Master message:

Slave address	08h
Function	06h
MSB register address	16h
LSB register address	03h
MSB data	00h
LSB data	1Eh
MSB CRC	FDh
LSB CRC	13h

Slave response:

The slave response is an echo to the query, that is the slave sends back to the master the address and the new value of the variable.

1.8 Function 07: Read Exception Status

This function allows to read the status of the automatic transfer switch.

Master query:

Slave address	08h
Function	07h
MSB CRC	47h
LSB CRC	B2h

The following table gives the meaning of the status byte sent by the ATC as answer:

BIT	MEANING
0	Operative mode OFF / Reset
1	Operative mode MAN
2	Operative mode AUT
3	Operative mode TEST
4	Error on
5	AC power supply present
6	DC power supply present
7	Global alarm on

1.9 Function 17: Report Slave ID

This function allows to identify the controller type.

Master query:

Slave address	08h
Function	11h
MSB CRC	C6h
LSB CRC	7Ch

Slave response:

Slave address	08h
Function	11h
Byte count	04h
Data 01 - Device type ①	61h
Data 02 - (SW revision)	04h
Data 03 - (Hardware revision)	00h
Data 04 - (Parameter revision)	01h
MSB CRC	..h
LSB CRC	..h

① 61h = ATC5300

1.10 Errors

In case the slave receives an incorrect message, it answers with a message composed by the queried function ORed with 80 Hex, followed by an error code byte.

The following table shows the error codes sent by the slave to the master:

Table 1: Error Codes

CODE	ERROR
01	Invalid function
02	Invalid address
03	Parameter out of range
04	Function execution impossible
06	Slave busy, function momentarily not available

1.11 Function 16: Preset Multiple Register

This function allows to modify multiple parameters with a single message, or to preset a value longer than one register. The address and the valid range for each parameter are stated in Table 3.

Master message:

Slave address	08h
Function	10h
MSB register address	20h
LSB register address	01h
MSB register number	00h
LSB register number	02h
MSB data	06h
LSB data	F4h
MSB data	06h
LSB data	83h
MSB CRC	55h
LSB CRC	3Ah

Slave response:

Slave address	08h
Function	10h
MSB register address	20h
LSB register address	01h
MSB byte number	00h
LSB byte number	04h
MSB CRC	9Bh
LSB CRC	53h

1.12 Modbus® ASCII Protocol

The Modbus® ASCII protocol is normally used in application that require to communicate through a couple of modems. The functions and addresses available are the same as for the RTU version, but the transmitted characters are in ASCII and the message end is delimited by carriage return / line feed instead of a transmission pause.

If one selects the parameter P7.04 and / or P7.07 as Modbus® ASCII protocol, the communication message on the correspondent communication port has the following structure:

:	Address (2 chars)	Function (2 chars)	Dates (N chars)	LRC (2 chars)	CR LF

- The Address field holds the serial address of the slave destination device.
- The Function field holds the code of the function that must be executed by the slave.
- The Data field contains data sent to the slave or data received from the slave in response to a query. The maximum allowable length is of 60 consecutive registers.
- The LRC field allows the master and slave devices to check the message integrity. If a message has been corrupted by electrical noise or interference, the LRC field allows the devices to recognize the error and thereby ignore the message.

- The message terminates always with CRLF control character (0D 0A).

Example:

For instance, to read the value of the phase-to-phase voltage, which resides at location 04 (04 Hex) from the slave with serial address 08, the message to send is the following:

:	08	04	00	03	00	02	EF	CRLF

Whereas:

: = ASCII 3Ah message start delimiter

08 = slave address

04 = Modbus® function "Read input register"

00 03 = Address of the required register (L2 voltage of line 1) decreased by one

00 02 = Number of registers to be read beginning from address 04

EF = LRC Checksum

CRLF = ASCII 0Dh 0Ah = Message end delimiter

The ATC answer is the following:

:	08	04	00	00	00	01	A0	4F	CRLF

Whereas:

: = ASCII 3Ah message start delimiter

08 = Multimeter address (Slave 08)

04 = Function requested by the master

04 = Number of bytes sent by the multimeter

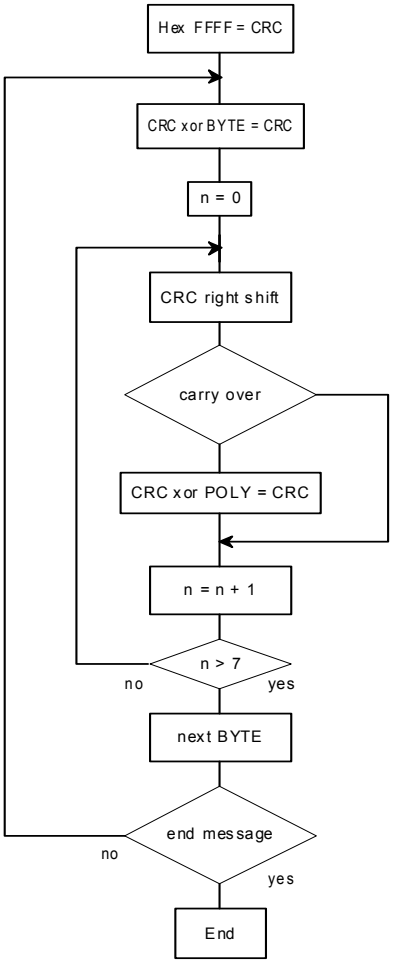
00 00 01 A0 = Hex value of the phase-to-phase voltage (416 V)

4F = LRC checksum

CRLF = ASCII 0Dh 0Ah = Message end delimiter

1.13 CRC Calculation (CHECKSUM for RTU)

CRC Calculation Workflow



XOR = exclusive or

n = number of information bits

POLY = calculation polynomial of the CRC 16 = 1010 0000 0000 0001

(Generating polynomial = $1 + x_2 + x_{15} + x_{16}$)

In the CRC 16, the 1st byte transmitted is the least significant one.

Example of CRC calculation:

Frame = 0207h

CRC initialization	**1111**	**1111**	**1111**	**1111**	
Load the first byte			0000	0010	
Execute xor with the first Byte of the frame	1111	1111	1111	1101	
Execute 1st right shift	0111	1111	1111	1110	**1**
Carry=1, load polynominal	1010	0000	0000	0001	
Execute xor with the polynominal	1101	1111	1111	1111	
Execute 2nd right shift	0110	1111	1111	1111	**1**
Carry=1, load polynominal	1010	0000	0000	0001	
Execute xor with the polynominal	1100	1111	1111	1110	
Execute 3rd right shift	0110	0111	1111	1111	**0**
Execute 4th right shift	0011	0011	1111	1111	**1**
Carry=1, load polynominal	1010	0000	0000	0001	
Execute xor with the polynominal	1001	0011	1111	1110	
Execute 5th right shift	0100	1001	1111	1111	**0**
Execute 6th right shift	0010	0100	1111	1111	**1**
Carry=1, load polynominal	1010	0000	0000	0001	
Execute xor with the polynominal	1000	0100	1111	1110	
Execute 7th right shift	0100	0010	0111	1111	**0**
Execute 8th right shift	0010	0001	0011	1111	**1**
Carry=1, load polynominal	1010	0000	0000	0001	
Load the second byte of the frame			0000	0111	
Execute xor with the polynominal Second byte of the frame	1000	0001	0011	1001	
Execute 1st right shift	0100	0000	1001	1100	**1**
Carry=1, load polynominal	1010	0000	0000	0001	
Execute xor with the polynominal	1110	0000	1001	1101	
Execute 2nd right shift	0111	0000	0100	1110	**1**
Carry=1, load polynominal	1010	0000	0000	0001	
Execute xor with the polynominal	1101	0000	0100	1111	
Execute 3rd right shift	0110	1000	0010	0111	**1**
Carry=1, load polynominal	1010	0000	0000	0001	
Execute xor with the polynominal	1100	1000	0010	0110	
Execute 4th right shift	0110	0100	0001	0011	**0**
Execute 5th right shift	0010	0100	0000	1001	**1**
Carry=1, load polynominal	1010	0000	0000	0001	
Execute xor with the polynominal	1001	0010	0000	1000	
Execute 6th right shift	0100	1001	0000	0100	**0**
Execute 7th right shift	0010	0100	1000	0010	**0**

Execute 8th right shift	0001	0010	0100	0001	**0**
CRC Result	0001	0010	0100	0001	
	|<------- 12h -------\>|		|<------- 41h -------\>|		

Data Library

2

2.1 Measurement Supplies

Measures supplies by Serial Communication Protocol (to be used with functions 03 and 04)

ADDRESS	WORDS	MEASURE	UNIT	FORMAT
02h	2	Voltage of line 1 L1-N	V	Unsigned long
04h	2	Voltage of line 1 L2-N	V	Unsigned long
06h	2	Voltage of line 1 L3-N	V	Unsigned long
08h	2	Voltage of line 1 L1-L2	V	Unsigned long
0Ah	2	Voltage of line 1 L2-L3	V	Unsigned long
0Ch	2	Voltage of line 1 L3-L1	V	Unsigned long
0Eh	2	Voltage of line 2 L1-N	V	Unsigned long
10h	2	Voltage of line 2 L2-N	V	Unsigned long
12h	2	Voltage of line 2 L3-N	V	Unsigned long
14h	2	Voltage of line 2 L1-L2	V	Unsigned long
16h	2	Voltage of line 2 L2-L3	V	Unsigned long
18h	2	Voltage of line 2 L3-L1	V	Unsigned long
1Ah	2	Frequency of line 1	Hz / 10	Unsigned long
1Ch	2	Frequency of line 2	Hz / 10	Unsigned long
1Eh	2	Battery voltage (DC power supply)	VDC / 10	Unsigned long
20h	2	Total operation time	s	Unsigned long
22h	2	Line 1 ok total time	s	Unsigned long
24h	2	Line 2 ok total time	s	Unsigned long
26h	2	Line 1 not ok total time	s	Unsigned long
28h	2	Line 2 not ok total time	s	Unsigned long
2Ah	2	Line 1 breaker closed total time	s	Unsigned long
2Ch	2	Line 2 breaker closed total time	s	Unsigned long
2Eh	2	Breaker opened total time	s	Unsigned long
30h	2	(not used)	—	Unsigned long
32h	2	Number of operations of line 1 breaker in AUT	nr	Unsigned long
34h	2	Number of operations of line 2 breaker in AUT	nr	Unsigned long
36h	2	Number of operations of line 1 breaker in MAN	nr	Unsigned long

38h	2	Number of operations of line 2 breaker in AUT	nr	Unsigned long
3Ah	2	Number of switching alarms of breaker 1	nr	Unsigned long
3Ch	2	Number of switching alarms of breaker 2	nr	Unsigned long
3Eh	2	(not used)	—	Unsigned long
40h	2	Error bits ①	bits	Unsigned long

① Reading the words starting at the address 40h will return 32 bits with the following meaning:

Bit	Code	Alarm
0	A01	Battery voltage too low
1	A02	Battery voltage too high
2	A03	Line 1 circuit breaker timeout
3	A04	Line 2 circuit breaker timeout
4	A05	Line 1 wrong phase sequence
5	A06	Line 2 wrong phase sequence
6	A07	Load not powered timeout
7	A08	Generator not available
8	A09	Emergency
9	—	(not used)
10	—	Breaker 1 Trip
11	—	Breaker 1 Withdrawn
12	—	Breaker 2 Trip
13	—	Breaker 2 Withdrawn
14 …31	—	(not used)

2.2 Status Bits

(To be used with functions 03 and 04)

ADDRESS	WORDS	FUNCTION	FORMAT
2070h	1	Front panel keyboard status ①	Unsigned integer
2071h	1	Digital inputs status (by pin) ②	Unsigned integer
2072h	1	Digital outputs status (by pin) ③	Unsigned integer
—	1	—	—
2074h	1	Line 1 voltage status ④	Unsigned integer
2075h	1	Line 1 breaker status ⑤	Unsigned integer
2076h	1	Line 2 voltage status ④	Unsigned integer
2077h	1	Line 2 breaker status ⑤	Unsigned integer
2078h	1	Input function status ⑥	Unsigned integer
207Ah	1	Output function status ⑦	Unsigned integer

① Following table shows meaning of bits of the word at address 2070h

Bit	Key
0	ON-OFF Line 2
1	Off mode
2	MAN mode
3	AUT mode
4	TEST mode
5	ON-OFF Line 1
6	Line 2 measure selection
7	Line 1 measure selection
8 …15	Not used

② Following table shows meaning of bits of the word at address 2071h

Bit	Input
0	Input terminal 4.1 status
1	Input terminal 4.2 status
2	Input terminal 4.3 status
3	Input terminal 4.4 status
4	Input terminal 4.5 status
5	Input terminal 4.6 status
6	Input terminal 4.7 status
7	Input terminal 4.8 status
8 …15	Not used

③ Following table shows meaning of bits of the word at address 2072h

Bit	Output
0	Output terminal 1.1 status
1	Output terminal 1.3 status
2	Output terminal 2.1 status
3	Output terminal 2.3 status
4	Output terminal 3.2 status
5	Output terminal 3.4 status
6	Output terminal 3.7 status
7 …15	Not used

④ Following table shows meaning of bits of the word at address 2074h (Line 1) and 2076h (Line 2):

Bit	Line Status
0	Line values into limits
1	Line values into limits delayed
2	Voltage into limits
3	Voltage ok
4	Frequency into limits
5	Frequency ok
6	Voltage below min
7	Voltage above max
8	Voltage asymmetry
9	Voltage phase loss
10	Frequency below min
11	Frequency above max
12	Wrong phase sequence
13	All line parameters ok
14 …15	Not used

⑤ Following table shows meaning of bits of the word at address 2074h (Line 1) and 2076h (Line 2):

Bit	Breaker Status
0	Breaker closed
1	Trip alarm
2	Withdrawn alarm
3	Command status (1 = close)
4	Close command output
5	Open command output
6 …15	Not used

⑥ Following table shows meaning of bits of the word at address 2078h:

Bit	Input Functions Status
0	Line 1 breaker closed feedback
1	Line 1 breaker trip
2	Line 1 breaker Withdrawn
3	Line 2 breaker closed feedback
4	Line 2 breaker trip
5	Line 2 breaker Withdrawn
6	Transfer to secondary line
7	Inhibit return to main line
8	Emergency pushbutton
9	Generator start
10	Generator 1 ready
11	Generator 2 ready
12	Keyboard locked
13	Lock parameters
14 …15	Not used

⑦ Following table shows meaning of bits of the word at address 207Ah:

Bit	Output Functions Status
0	Line 1 breaker open
1	Line 1 breaker close
2	Line 2 breaker open
3	Line 2 breaker close
4	Global alarm
5	Generator 1 start
6	Generator 2 start
7	ATS ready
8	Load shed
9	Pre-transfer
10	Post-transfer
11 …15	Not used

2.3 Commands

(To be used with function 06)

ADDRESS	WORDS	FUNCTION	FORMAT
2F00h	1	Operative mode change ①	Unsigned integer
2F01h	1	Device reset (warm boot) ②	Unsigned integer
2F02h	1	Setup parameters back to factory default ②	Unsigned integer
2F03h	1	Save parameters in EEPROM ③	Unsigned integer
2F04h	1	Hour counter reset ④	Unsigned integer
2F05h	1	Operation counters reset ④	Unsigned integer
2F06h	1	Event log reset ②	Unsigned integer
2F07h	1	Save Real time clock setting ②	Unsigned integer
2F08h	1	Keyboard lock ON / OFF ⑤	Unsigned integer
—	—	—	—
2F0Dh	1	Front panel keystroke simulation ⑥	Unsigned integer

① The following table shows the values to be written to address 2F00h to achieve the correspondent functions.

Value	Function
0	Switch to OFF mode
1	Switch to MAN mode
2	Switch to AUT mode
3	Switch to TEST mode

② Writing value 01 to the indicated address, the correspondent function will be executed.

③ Writing value AAh to the indicated address, the correspondent function will be executed.

④ Writing value FFh to the indicated address, the correspondent function will be executed.

⑤ The following table shows the values to be written to address 2F08h to achieve the correspondent functions.

Value	Function
0	Keyboard unlock
1	Keyboard lock

⑥ The following table shows the bit positions of the value to be written to address 2F0Dh to achieve the correspondent functions.

Value	Keystroke simulation
0	Line 2 manual switching
1	OFF mode
2	MAN mode
3	AUT mode
4	TEST mode
5	Line 1 manual switching
6	Line 2 measure selection
7	Line 1 measure selection
8 …15	Not used

2.4 Parameter Setting

Using the Modbus® protocol it is possible to access the menu parameters. In the following tables it is reported the numerical range for each parameter. To correctly understand the correspondence between the numeric value and the selected function and/or the unit of measure, please see the ATC operating manual. To make effective the changes made to setup parameters it is necessary to store the values in EEPROM, using the dedicated command described in table 3.

2.5 Setup Parameters

(To be used with functions 04 and 06)

ADDRESS	WORDS	PARAMETER	RANGE	FORMAT
3000h	1	P1.01 Nominal voltage	100 … 690	Unsigned integer
3001h	1	P1.02 VT ratio	100 … 999	Unsigned integer
3002h	1	P1.03 Wiring configuration	0 … 3 ①	Unsigned integer
3003h	1	P1.04 Voltage control mode	0 … 2 ①	Unsigned integer
3004h	1	P1.05 Nominal frequency	0 … 1 ①	Unsigned integer
3005h	1	P1.06 Nominal battery voltage	0 … 3 ①	Unsigned integer
3100h	1	P2.01 Application type	0 … 2 ①	Unsigned integer
3101h	1	P2.02 Phase sequence control	0 … 2 ①	Unsigned integer
3102h	1	P2.03 Priority line selection	0 … 1 ①	Unsigned integer
3103h	1	P2.04 Line1 → Line2 interlock time	100 … 900	Unsigned integer
3104h	1	P2.05 Line2 → Line1 interlock time	100 … 900	Unsigned integer
3105h	1	P2.06 Transfer strategy	0 … 1 ①	Unsigned integer
3106h	1	P2.07 Switch command mode	0 … 2 ①	Unsigned integer
3107h	1	P2.08 Switch open / close timeout	1 … 900	Unsigned integer
3108h	1	P2.09 Switch open pulse duration	1 … 600	Unsigned integer

3109h	1	P2.10 Switch close pulse duration	1 … 600	Unsigned integer
310Ah	1	P2.11 Load not powered timeout	0 … 3600 ②	Unsigned integer
310Bh	1	P2.12 Inhibit auto retransfer	0 … 1 ①	Unsigned integer
310Ch	1	P2.13 Pre-transfer time	0 … 300 ②	Unsigned integer
310Dh	1	P2.14 Post-transfer time	0 … 300 ②	Unsigned integer
310Eh	1	P2.15 Generator start delay	0 … 900	Unsigned integer
310Fh	1	P2.16 Generator cooling time	1 … 3600	Unsigned integer
3110h	1	P2.17 Generator rotation time	0 … 14 ①	Unsigned integer
3111h	1	P2.18 Generator rotation hour	0 … 23	Unsigned integer
3112h	1	P2.19 Generator rotation minutes	0 … 59	Unsigned integer
3113h	1	P2.20 Min battery voltage	69 … 100 ②	Unsigned integer
3114h	1	P2.21 Max battery voltage	100 … 141 ③	Unsigned integer
3115h	1	P2.22 Battery alarm delay	0 … 60	Unsigned integer
3116h	1	P2.23 Set clock at power-on	0 … 1 ④	Unsigned integer
3117h		P2.24 Voltage control in manual	0 … 1 ①	Unsigned integer
3118h		P2.25 Continuous command in OFF / RESET mode	0 … 1 ④	Unsigned integer
3119h		P2.26 EJP start delay	0 … 3600 ②	Unsigned integer
3200h	1	P3.01 Min voltage drop out	70 … 98	Unsigned integer
3201h	1	P3.02 Min voltage pick up	75 … 100	Unsigned integer
3202h	1	P3.03 Min voltage delay	1 … 9000	Unsigned integer
3203h	1	P3.04 Max voltage drop out	102 … 121 ③	Unsigned integer
3204h	1	P3.05 Max voltage pick up	100 … 115	Unsigned integer
3205h	1	P3.06 Max voltage delay	1 … 9000	Unsigned integer
3206h	1	P3.07 Phase loss threshold	59 … 85 ②	Unsigned integer
3207h	1	P3.08 Phase loss delay	1 … 300	Unsigned integer
3208h	1	P3.09 Asymmetry threshold	2 … 21 ③	Unsigned integer
3209h	1	P3.10 Asymmetry delay	1 … 9000	Unsigned integer
320Ah	1	P3.11 Min frequency	79 … 100 ②	Unsigned integer
320Bh	1	P3.12 Min frequency delay	1 … 9000	Unsigned integer
320Ch	1	P3.13 Max frequency	100 … 121 ③	Unsigned integer
320Dh	1	P3.14 Max frequency delay	1 … 9000	Unsigned integer
320Eh	1	P3.15 Line 1 ok delay (when line 2 not OK)	1 … 3600	Unsigned integer
320Fh	1	P3.16 Line 1 ok delay (when line 2 OK)	1 … 3600	Unsigned integer
3300h	1	P4.01 Min voltage drop out	0 … 3600 ②	Unsigned integer
3301h	1	P4.02 Min voltage pick up	0 … 1 ①	Unsigned integer
3302h	1	P4.03 Min voltage delay	0 … 300 ②	Unsigned integer
3303h	1	P4.04 Max voltage drop out	0 … 300 ②	Unsigned integer
3304h	1	P4.05 Max voltage pick up	0 … 900	Unsigned integer
3305h	1	P4.06 Max voltage delay	1 … 3600	Unsigned integer
3306h	1	P4.07 Phase loss threshold	0 … 14 ①	Unsigned integer
3307h	1	P4.08 Phase loss delay	0 … 23	Unsigned integer
3308h	1	P4.09 Asymmetry threshold	0 … 59	Unsigned integer

3309h	1	P4.10 Asymmetry delay	69 … 100 ②	Unsigned integer
330Ah	1	P4.11 Min frequency	100 … 141 ③	Unsigned integer
330Bh	1	P4.12 Min frequency delay	0 … 60	Unsigned integer
330Ch	1	P4.13 Max frequency	0 … 1 ④	Unsigned integer
330Dh	1	P4.14 Max frequency delay	0 … 1 ①	Unsigned integer
330Eh	1	P4.15 Line 1 ok delay (when line 1 not OK)	1 … 3600	Unsigned integer
330Fh	1	P4.16 Line 1 ok delay (when line 1 OK)	1 … 3600	Unsigned integer
3400h	1	P5.01 Programmable Input 1 function	0 …19 ①	Unsigned integer
3401h	1	P5.02 Programmable Input 1 function	0 …19 ①	Unsigned integer
3402h	1	P5.03 Programmable Input 1 function	0 …19 ①	Unsigned integer
3403h	1	P5.04 Programmable Input 1 function	0 …19 ①	Unsigned integer
3404h	1	P5.05 Programmable Input 1 function	0 …19 ①	Unsigned integer
3405h	1	P5.06 Programmable Input 1 function	0 …19 ①	Unsigned integer
3406h	1	P5.07 Programmable Input 1 function	0 …19 ①	Unsigned integer
3407h	1	P5.08 Programmable Input 1 function	0 …19 ①	Unsigned integer
3500h	1	P6.01 Programmable output 1 function	0 …14 ①	Unsigned integer
3501h	1	P6.02 Programmable output 1 function	0 …14 ①	Unsigned integer
3502h	1	P6.03 Programmable output 1 function	0 …14 ①	Unsigned integer
3503h	1	P6.04 Programmable output 1 function	0 …14 ①	Unsigned integer
3504h	1	P6.05 Programmable output 1 function	0 …14 ①	Unsigned integer
3505h	1	P6.06 Programmable output 1 function	0 …14 ①	Unsigned integer
3506h	1	P6.07 Programmable output 1 function	0 …14 ①	Unsigned integer
3600h	1	P7.01 RS 232 serial address	1 …245	Unsigned integer
3601h	1	P7.02 RS 232 serial speed	0 …4 ①	Unsigned integer
3602h	1	P7.03 RS 232 protocol	0 …4 ①	Unsigned integer
3603h	1	P7.04 RS 232 parity	0 …4 ①	Unsigned integer
3604h	1	P7.05 RS 485 serial address	1 …245	Unsigned integer
3605h	1	P7.06 RS 485 serial speed	0 …4 ①	Unsigned integer
3606h	1	P7.07 RS 485 protocol	0 …4 ①	Unsigned integer
3607h	1	P7.08 RS 485 parity	0 …4 ①	Unsigned integer
3700h	1	P8.01 Automatic test enable	0 …1 ①	Unsigned integer

3701h	1	P8.02 Interval time (days)	1 …60	Unsigned integer
3702h	1	P8.03 Enable test on Monday	0 …1 ①	Unsigned integer
3703h	1	P8.04 Enable test on Tuesday	0 …1 ①	Unsigned integer
3704h	1	P8.05 Enable test on Wednesday	0 …1 ①	Unsigned integer
3705h	1	P8.06 Enable test on Thursday	0 …1 ①	Unsigned integer
3706h	1	P8.07 Enable test on Friday	0 …1 ①	Unsigned integer
3707h	1	P8.08 Enable test on Saturday	0 …1 ①	Unsigned integer
3708h	1	P8.09 Enable test on Sunday	0 …1 ①	Unsigned integer
3709h	1	P8.10 Auto test begin hour	0 …23	Unsigned integer
370Ah	1	P8.11 Auto test begin minutes	0 …59	Unsigned integer
370Bh	1	P8.12 Duration time	0 …600	Unsigned integer
370Ch	1	P8.13 On load switching	0 …1 ①	Unsigned integer

① The association between the numerical value and the function has to be done in a sequential way, considering the function listed on the operative manual. The first function is obtained by setting 0, while the last function by setting the maximum value allowed by the range.

② To select OFF, set the minimum numerical value allowed by range.

③ To select OFF, set the maximum numerical value allowed by range.

④ The association between the numerical value and the function has to be done in a sequential way, considering the function listed on the operative manual. The first function is obtained by setting the maximum value allowed by the range, while the last function by setting value 0.

2.6 Real Time Clock

(To be used with functions 04 and 06)

To make the changes effective, store them using the dedicated command described in table 3.

ADDRESS	WORDS	PARAMETER	RANGE	FORMAT
2F20h	1	Seconds	0 ..59	Unsigned integer
2F21h	1	Minutes	0 ..59	Unsigned integer
2F22h	1	Hours	0 ..23	Unsigned integer
2F23h	1	Weekday	1 ..7	Unsigned integer
2F24h	1	Day	0 ..31	Unsigned integer
2F25h	1	Month	1 ..12	Unsigned integer
2F26h	1	Year (2000 →)	0 ..99	Unsigned integer

2.7 Event Log Reading

The events history is stored in a circular buffer memory. To rebuild the correct time sequence, it is necessary to read the position of the most recent event, indicated by the buffer pointer, and go backward starting from it for a number of positions equal to the one indicated by the event counter.

If the head of the circular buffer is reached (pos. 1), then it is necessary to move to the last position (pos. 100, tail) and then go back until the most recent event is reached again. Time stamp values are returned in compacted format, in three registers containing each a couple of data. For instance register 2100h holds in the MSB the hours and in LSB minutes. The same criteria is applied to seconds / day and month / year.

2.8 Event Log Pointers

(To be used with function 04)

ADDRESS	WORDS	PARAMETER	RANGE	FORMAT
2510h	1	Pointer to the most recent event position	0 ..99	Unsigned integer
2511h	1	Counter of the stored events number	0 ..99	Unsigned integer

2.9 Event Log

(To be used with function 04)

ADDRESS	WORDS	PARAMETER	RANGE	FORMAT
2100h	1	Event pos. 1 - Hours / Minutes	0…23 / 0…59	Unsigned integer
2101h	1	Event pos. 1 - Seconds / Day	0…59 / 0…31	Unsigned integer
2102h	1	Event pos. 1 - Month / Year	0…12 / 0…99	Unsigned integer
2103h	1	Event pos. 1 - Event code ①	1 …225	Unsigned integer
2104h	1	Event pos. 2 - Hours / Minutes	0…23 / 0…59	Unsigned integer
2105h	1	Event pos. 2 - Seconds / Day	0…59 / 0…31	Unsigned integer
2106h	1	Event pos. 2 - Month / Year	0…12 / 0…99	Unsigned integer
2107h	1	Event pos. 2 - Event code ①	1 …225	Unsigned integer
—	—	—	—	—
228Ch	1	Event pos. 100 - Hours / Minutes	0…23 / 0…59	Unsigned integer
228Dh	1	Event pos. 100 - Seconds / Day	0…59 / 0…31	Unsigned integer
228Eh	1	Event pos. 100 - Month / Year	0…12 / 0…99	Unsigned integer
228Fh	1	Event pos. 100 - Event code ①	1 …225	Unsigned integer

① The meaning of the event code can be found in the following table. In case there is no recorded event code 0 will be returned.

2.9.1 Event Log - Numeric Code / Event Type Correspondence

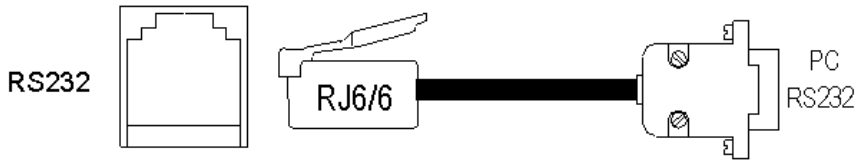
Code	Event
1	ATC Power on
2	ATC Power off
3	ATC Reboot
5	Mode changed to RESET-OFF
6	Mode changed to MAN
7	Mode changed to AUT
8	Mode changed to TEST
10	External generator start (begin)
11	External generator start (end)
12	External transfer signal (begin)
13	External transfer signal (end)
20	Automatic test enabled
21	Automatic test disabled

22	Begin of automatic test
23	End of automatic test
26	Start command to generator 1
27	Stop command to generator 1
28	Start command to generator 2
29	Stop command to generator 2
30	Manual start command
31	Manual stop command
32	Manual switch line 1
33	Manual switch line 2
34	Begin of line failure simulation
35	End of line failure simulation
36	Begin of Test on load
37	End of Test on load
40	Line 1 into limits
41	Line 1 out of limits
42	Line 1 present
43	Line 1 absent
44	Line 1 voltage into limits
45	Line 1 voltage out of limits
46	Line 1 frequency into limits
47	Line 1 frequency out of limits
48	Line 1 phase sequence ok
49	Line 1 phase sequence wrong
50	Line 1 asymmetry into limits
51	Line 1 asymmetry out of limits
52	Line 1 switch closed
53	Line 1 switch opened
54	Line 1 voltage below minimum
55	Line 1 voltage above minimum
56	Line 1 phase failure
57	Line 1 frequency below minimum
58	Line 1 frequency above maximum
60	Line 2 into limits
61	Line 2 out of limits
62	Line 2 present
63	Line 2 absent
64	Line 2 voltage into limits
65	Line 2 voltage out of limits
66	Line 2 frequency into limits
67	Line 2 frequency out of limits
68	Line 2 phase sequence ok
69	Line 2 phase sequence wrong
70	Line 2 asymmetry into limits
71	Line 2 asymmetry out of limits

72	Line 2 switch closed
73	Line 2 switch opened
74	Line 2 voltage below minimum
75	Line 2 voltage above minimum
76	Line 2 phase failure
77	Line 2 frequency below minimum
78	Line 2 frequency above maximum
80	Alarms manual reset
81	Begin of alarm A01 - Low battery voltage
82	Begin of alarm A02 - High battery voltage
83	Begin of alarm A03 - Line 1 switch fault
84	Begin of alarm A04 - Line 2 switch fault
85	Begin of alarm A05 - Line 1 wrong phase sequence
86	Begin of alarm A06 - Line 2 wrong phase sequence
87	Begin of alarm A07 - Load not powered timeout
88	Begin of alarm A08 - Generator not ready
89	Begin of alarm A09 - Emergency stop
90	Begin of alarm A10
91	Begin of alarm - Line 1 breaker Trip
92	Begin of alarm - Line 2 breaker Trip
93	Begin of alarm - Line 1 breaker Withdrawn
94	Begin of alarm - Line 2 breaker Withdrawn
95	Begin of alarm A15
96	Begin of alarm A16
97	Begin of alarm A17
98	Begin of alarm A18
99	Begin of alarm A19
100	Begin of alarm A20
101	End of alarm A01 - Low battery voltage
102	End of alarm A02 - High battery voltage
103	End of alarm A03 - Line 1 switch fault
104	End of alarm A04 - Line 2 switch fault
105	End of alarm A05 - Line 1 wrong phase sequence
106	End of alarm A06 - Line 2 wrong phase sequence
107	End of alarm A07 - Load not powered timeout
108	End of alarm A08 - Generator not ready
109	End of alarm A09 - Emergency stop
110	End of alarm A10
111	End of alarm - Line 1 breaker Trip
112	End of alarm - Line 2 breaker Trip
113	End of alarm - Line 1 breaker Withdrawn
114	End of alarm - Line 2 breaker Withdrawn
115	End of alarm A15
116	End of alarm A16
117	End of alarm A17

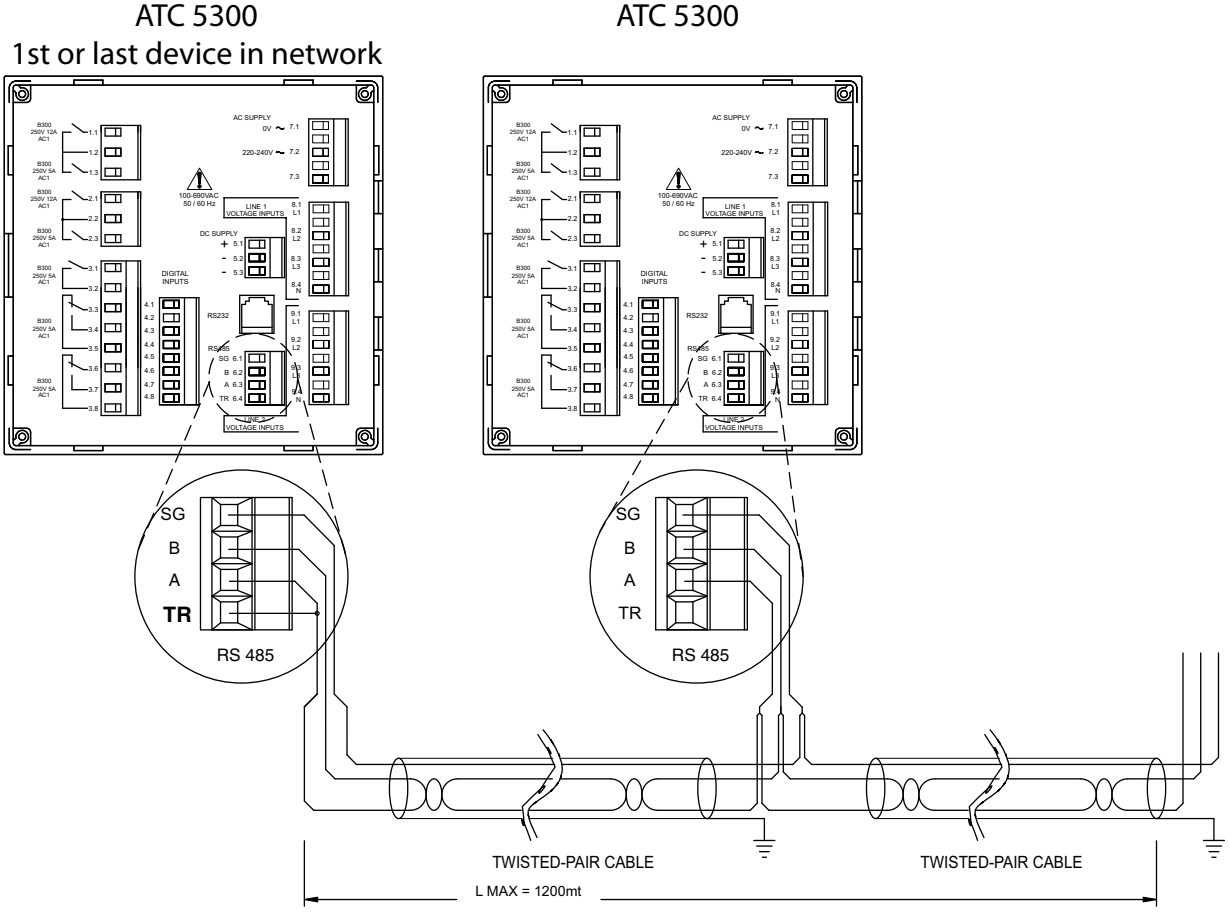
118	End of alarm A18
119	End of alarm A19
120	End of alarm A20
130	Menu P1 modified
131	Menu P2 modified
132	Menu P3 modified
133	Menu P4 modified
134	Menu P5 modified
135	Menu P6 modified
136	Menu P7 modified
137	Menu P8 modified
138	Menu P9 modified
139	Menu P10 modified
140	Real time clock modified
141	Setup parameters reset to default
142	Keyboard unlocked
143	Keyboard locked
150	Event log cleared
151	Hour meters cleared
152	Operation counters cleared
210	Begin of remote control
211	End of remote control
212	Incoming call from modem
213	Modem line closed
214	Modem call to PC
215	Connection to PC ok
216	Connection to PC failed
217	SMS sent to user 1
218	SMS sent to user 2
219	SMS sent to user 3
220	SMS sending ok
221	SMS sending failed
222	E-mail sending
223	E-mail sent ok
224	E-mail sending failed
225	Incoming SMS commands

2.10 PC-ATC Connection via RS 232 Cable



The cable can be ordered with the SENTRON SOFTWARE ATC
Order number: 3KC9000-8TL70

2.11 PC-ATC5300 Connection via RS 485



User can connect through standard interface which works as COM Port.