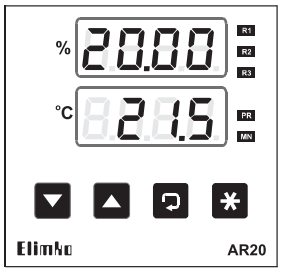
K - Q
TSE-ISO-EN
9000

TS EN ISO 9001
Quality Management System Certificate

KY-AR20-0219-0

Elimko Elektronic Production and Control Co. Ltd.
8. Cad. 21.Sk. No:16 Emek 06510 Ankara / TURKEY
Phone: + 90 312 212 64 50 Fax: + 90 312 212 41 43
www.elimko.com.tr • e-mail:elimko@elimko.com.tr

E-AR-20 WOOD MOISTURE METER USER MANUAL

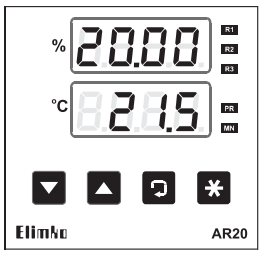


Manufacturer / Technical Support
Elimko Elektronic Production and Control Co. Ltd.
8. Cad. 21.Sk. No:16 Emek 06510 Ankara / TURKEY
Phone: + 90 312 212 64 50 Fax: + 90 312 212 41 43
www.elimko.com.tr • e-mail:elimko@elimko.com.tr

E-AR-20 controller is designed for panel mounting and should be used in an industrial environment.

- The package of E-AR-20 controller contains;
  Controller,
  2 pieces of mounting clamps,
  User manual,
  Guarantee certificate.
- After opening the package, please check the contents with the above list.
- If the delivered product is wrong type,any item is missing or there are visible defects, contact the vendor from which you purchased the product.
- Before installing and operating the controller, please read the user manual thoroughly.
- The installation and configuration of the controller must only be performed by a person qualified in instrumentation.
  Keep the unit away from flamable gases, that could cause explosion.
- Do not use alcohol or other solvents to clean the controller.
  Use a clean cloth soaked in water tightly squeezed to gently wipe the outer surface of the controller.
- It is not used in medical applications.

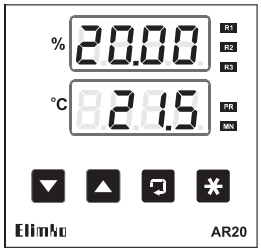
1. DESCRIPTION



The E-AR-20 is a specially designed instrument for measuring wood moisture content. The instrument is based on the resistance measurement method. In addition to resistance measurement, the device can also measure wood temperature with an external Pt-100 temperature sensor in order to account temperature effect into moisture calculation for more accuracy.

The measurement range of the instrument is 10% - 70% MC. E-AR-20 is housed in a 96x96 mm plastic case conforming IEC/TR 60668 standard. Operating voltage is 85-265 V AC or 85-375 V DC.

2. OPERATION



The front panel view of E-AR-20 instrument is shown in Figure 2.1. There are two displays on the front panel. The upper display shows the “MC%” (Moisture Content), the lower display shows the temperature value (°C). To the right of the displays are the R1, R2, R3, PR and MN leds. The state of the output relays (RL1 and RL2) are indicated by the R1 and R2 leds. PR led lits during configuration mode, MN led lits when the temperature compensation is active. During the normal operation mode (start screen), press ↵ button to reach A1SP and A2SP alarm set points respectively [1]. These parameters can be changed with ▼ and ▲ buttons. Press ✳ button to return to the normal operation mode.

3. TYPE CODING

E–AR–20–U–V–W–X–Y–Z

- U:
  - 0: 85-265 V AC / 85-375 V DC
  - 1: 20-60 V AC / 20-85 V DC
- V:
  - 1: Panel Mounting (96x96)
  - 2: Wall Type (in panel)
- W:
  - 0: No Probe
  - 1: Probe (Probe without cable)
  - 2: Probe (Probe without 5m cable)
  - 3: Probe (Probe without 10m cable)
  - 4: Probe (Probe without 15m cable)
- X:
  - 0: None
  - 1: RS485 MODBUS
- Y:
  - 1: 1 Analog Output (0-20 / 4-20 mA) isolated
- Z:
  - 0: None
  - 1: 1 Relay
  - 2: 2 Relay

Standard Specifications: 1 Analog Output
1 Pt-100 Input

4. CONFIGURATION

In order to enter configuration mode, ↵ and ✳ buttons must be pressed simultaneously. After this operation, "CoD" message will be displayed on the upper display and the initial value of security code is displayed in the lower display as "0". The security code is adjusted by ▼ and ▲ buttons. After entering the security code and pressing the ↵ button, the alarm configuration page (PAGE/ACnF) is accessed. At this state, ▼ and ▲ buttons can be used to select the other pages (oCnF or GCnF). After page selection, successively pressing the ↵ button will display the parameters in selected page. The name of the parameter is displayed in the upper display and the value of the parameter is displayed in the lower display. The parameter values can be edited by ▼ and ▲ buttons. If ↵ button is pressed for a duration of 3 seconds, page menu is reached and a new page can be selected.

The parameters on the ACnF, oCnF and GCnF pages are given in **Table 4.1**. The parameters are explained in section **5. EXPLANATION OF THE PARAMETERS.**

The ✳ button is used to exit from the configuration operation.

4. CONFIGURATION

The factory setting of the password (SCod) is "10". The user can adjust the password to any value between 0 and 9999. In case the password is forgotten, the power of the instrument must be reapplied and within 30 seconds of power on, ▼, ▲ and ✳ buttons should be pressed simultaneously. This operation enables the user to enter configuration mode without a password check only once.

Table 4.1 Parameters in Program Page

Page	1.Par.	2.Par.	3.Par.	4.Par.	5.Par.	6.Par.	7.Par.	8.Par.
ACnF[1]	rL Id	A 1SP	A 1HY	A 1tP	rL2d	A2SP	A2HY	A2tP
oCnF	Aor	2Ero	SPAn	–	–	–	–	–
GCnF	AtyP	tCAP	oFSt	Adrs	brtE	PrtY	SCod[2]	–

[1] If rL Id is adjusted as off, the parameters A 1SP, A 1HY, A 1tP are not active. In the same way if rL2d is adjusted as off, the parameters A2SP, A2HY, A2tP are not active.

[2] The SCod parameter can only be displayed with the correct password.

5. EXPLANATION OF THE PARAMETERS

CoD: Password is asked with this message while entering into the configuration operation. If the entered password is not correct, all parameters except SCod can be displayed but cannot be modified.

5.1. ACnF Page:

rL Id : Relay 1 alarm trigger source. It can be set as oFF (Closed), HUMd (%MC) or tEMP (Temperature).

A 1SP : Alarm 1 set point. It can be adjusted between 0 and 9999.

A 1HY : Alarm 1 hysteresis. It can be adjusted between 0 and 9999.

A 1tP : Alarm 1 type. It can be set as Lo (low alarm) or H I (high alarm).

rL2d : Relay 2 alarm trigger source. It can be set as oFF (Closed), HUMd (%MC) or tEMP (Temperature).

A2SP : Alarm 2 set point. It can be adjusted between 0 and 9999.

A2HY : Alarm 2 hysteresis. It can be adjusted between 0 and 9999.

A2tP : Alarm 2 type. It can be set as Lo (low alarm) or H I (high alarm).

5.2. oCnF Page:

Aor : %MC measurement analog retransmission range. Analog output scale, 0-20, 20-0, 4-20, 20-4 mA adjustable.

2Ero : This parameter defines the %MC value that corresponds to low limit of analog output. It can be adjusted between 0 and SPAn.

SPAn : This parameter defines the %MC value that corresponds to upper limit of analog output. It can be adjusted between 2Ero and 100.0.

5. EXPLANATION OF THE PARAMETERS

5.3. GCnF Page:

AtyP : AR-20 series are programmed with 3 predefind wood species named as t 1P 1, t 1P2 and t 1P3. Please check **Table 5.3.1** for the list of woods for each species. User should select appropriate species group in order to perform an accurate measurement. If the wood type to be measured does not exist in any three of wood species group, the user can opt for a custom **Resistance / %MC** table and can use the **PC Configuration Software (please see section 10)** to download the custom table to the device by overriding any of these three species group.

tCAP : %MC measurement temperature compensation selection. It can be set as oFF or on. If oFF is selected, temperature compensation is not performed while humidity measurement is being performed. If on is selected, temperature compensation is performed while humidity measurement is being performed. (Temperature compensation is automatically disabled in case of an unconnected, broken or out of range temperature sensor.)

oFSt : Temperature measurement offset value. It is used to correct the error caused by the line resistance. It can be adjusted between -10.0 and 10.0.

Adrs : It is communication address of the device. It can be adjusted between 1 and 127.

brtE : This parameter determines the communication baud rate. It can be set as 9.6, 19.2 or 38.4 bits/sec.

PrtY : This parameter determines the communication parity. It can be set as nonE, odd and EvEn.

SCod : Password configuration. It can be adjusted between 0 and 9999. Default password value is 10.

Table 5.3.1 Wood Species

abura	Type 2	birch	Type 2	emien (=african alstonia)	Type 1
african alstonia	Type 1	black afara	Type 2	european aspen	Type 1
african canarium	Type 1	briar	Type 1	fir	Type 2
african walnut	Type 1	ceder	Type 2	fromager (=ceiba)	Type 1
afrormosia	Type 3	ceiba	Type 1	gaboon	Type 2
afzelia	Type 2	cembra pine	Type 1	hevea	Type 3
agba	Type 1	cherry tree	Type 1	hickory	Type 2
alder	Type 1	chestnut, horse	Type 1	hickory, bitternut	Type 2
alder, common	Type 1	chestnut, sweet	Type 1	hickory, poplar	Type 1
alder, red	Type 1	common beech	Type 2	hickory, swap	Type 2
alerce	Type 1	cypress, c. lusit	Type 2	holm oak	Type 1
alstonia	Type 1	cypress, real	Type 1	hornbeam	Type 1
andiroba	Type 1	dahoma	Type 2	ilomba	Type 2
ash (EUR)	Type 2	daniellia (= ogea)	Type 1	imbuia	Type 3
ash (AM)	Type 3	douka (= makore)	Type 1	ipe	Type 2
balsa	Type 1	douglas Fir	Type 3	iroko	Type 2
basralocus	Type 1	ebony	Type 2	izombé	Type 1
berlinia	Type 1	ekki	Type 1	jacareuba	Type 1
beech	Type 2	elm	Type 1		

Table 5.3.1 Wood Species

jarrah	Type 1	mockernut	Type 2	red oak, american	Type 2
kambala (= iroko)	Type 2	niangon	Type 2	red sandelwood	Type 1
karri	Type 1	niové	Type 2	rio rosewood	Type 2
keruing	Type 1	niové bidinkala	Type 3	rosewood	Type 2
khaya	Type 1	oak	Type 3	stone pine	Type 1
kokrodua	Type 3	oak, holm	Type 1	spruce	Type 1
kosipo (= omu)	Type 1	oak, sessile	Type 1	teak	Type 2
lapacho (= ipe)	Type 2	obeche	Type 2	tola, branca	Type 1
larch (EUR)	Type 2	okoumé	Type 2	tola, real	Type 3
limba	Type 1	omu	Type 1	tola, red	Type 3
lime	Type 2	oregon pine	Type 1	trembling poplar	Type 1
lime, american	Type 2	parana pine	Type 2	walnut	Type 1
logwood	Type 1	patagonian cypress	Type 1	western red cedar	Type 1
maple	Type 2	pear	Type 2	white oak, american	Type 2
mahogany	Type 1	pencil cedar	Type 1	white poplar	Type 1
makore	Type 1	pine	Type 1	willow	Type 2
makoré (african pear)	Type 1	poplar	Type 3	yellow birch	Type 1
maritime pine	Type 1	plum tree	Type 1	yellow pine	Type 1
melêze	Type 1	purpleheart	Type 1		

6. CONNECTION DIAGRAMS

The back panel view of the E-AR-20 device is shown in **Figure 6.2**. The connection terminals of the device is given in **Table 6.1** according to the terminal numbers.

Table 6.1 Connection Terminals

Connections	Terminal	
Operating Voltage	9,10	85-265 V AC or 85-375 V DC
Pt-100 Input	19, 20	Connect the Pt-100 to terminals 19 and 20.
Probe Input	+16, 18, 32 33, 34, 35	Terminals 16-33 and 18-32 are short-circuited. The probe is connected to terminals 34 and 35.
Analog Output	11,12	Analog output is taken from terminals 11 (+) and 12 (-).
RL1 Output	1, 2	Normally open contact
RL2 Output	3, 4	Normally open contact
Communication	27, 28, 29	Number 27 is TRXB lead, number 28 is TRXA and number 29 is common lead (GND).

NOTE: Other than the above mentioned terminals must be left unconnected.

Operating voltage of the device is applied from terminals 9 and 10. Devices with nominal 220 V AC input can be used with 85-265 V AC or 85-375 V DC operating voltage.

6. CONNECTION DIAGRAMS

E-AR-20 devices are provided with a moisture probe and associated connection plugs. As seen in **Figure 6.1**, the probe consists of two nail type electrodes, two connection sockets and an insertion handle for easy installation of probe to the wood. For the electrical connection of probe to device, a connection cable that is long enough for planned installation, should be terminated with connection plugs at one end for probe connection and the other end should be terminated at terminals 14 and 17 with proper wiring. The connection cable should be twisted and shielded with a minimum diameter of 21 AWG. The maximum recommended cable length is 15 meters. For a proper insertion of probe to the wood, the handle should be unscrewed by rotating the handle counter-clockwise until the handle bottom end reaches to the nut level. In other words, the handle should be elevated to the all the way up to electrode nails than the probe should be nailed to a proper position on the top of the wood.
The penetration length should be at least half of the length of nails and should be kept same between measurements for a better measurement repeatability as it affect the resistance calculation. For extraction of probe from the wood, the handle should be screwed by rotating clockwise until it pulls the probe out of the wood by pressing against to wood surface. Probe nails can be replaced using replacement nuts with spare conductive nail type electrodes in case of any wear and malfunction.
NOTE: The measurement method and the accuracy of the measurement method are explained in the "AS/NZS 1080.1:2012 Timber - Methods of test - Method 1: Moisture content" standard.

6. CONNECTION DIAGRAMS

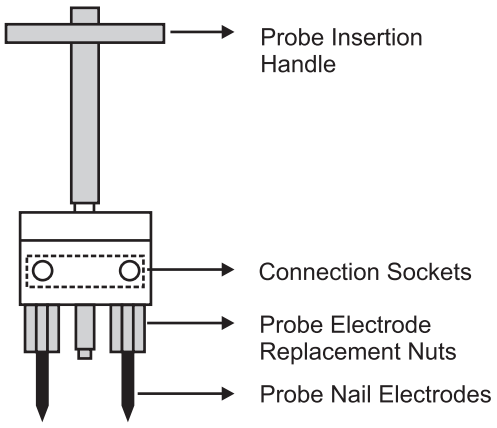


Figure 6.1 Wood Moisture Probe

6. CONNECTION DIAGRAMS

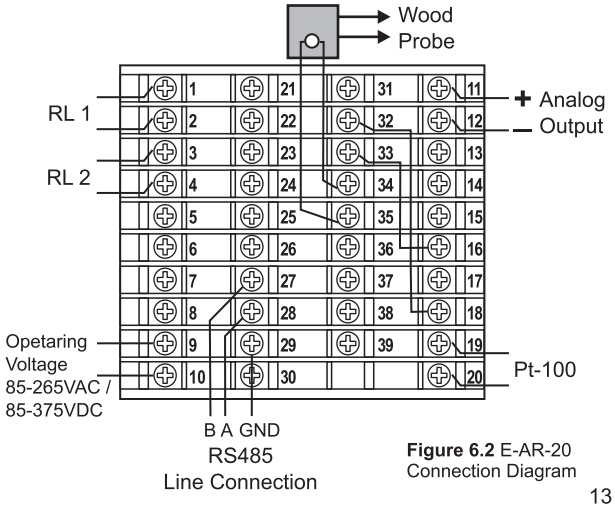


Figure 6.2 E-AR-20 Connection Diagram

7. MODBUS REGISTERS ADDRESSES

E-AR-20 with RS485 communication option can be controlled and monitored through a central system according to the Modbus RTU protocol on the RS485 communication line. Function codes 03, 06 and 16 are supported. Parameter addresses are given in the table below. Parameters, the properties of which are R are read-only; parameters which are R/W are both readable and writeable.

Table 6.1 The Modbus Register Addresses of E-AR-20

Address	Parameter	Feature	Min	Max	Explanation
0	Moisture	R	-	-	-
1	Temperature	R	-	-	-
2 - 5	Reserved	R	-	-	-
6	rL Id	R	0	2	0: oFF, 1: HUñd, 2: tEñP
7	A ISP	R/W	0	9999	-
8	A IHY	R/W	0	9999	-
9	A ItP	R/W	0	1	0: Lo, 1: H I
10	rL2d	R/W	0	2	0: oFF, 1: HUñd, 2: tEñP
11	A2SP	R/W	0	9999	-
12	A2HY	R/W	0	9999	-
13	A2tP	R/W	0	1	0: Lo, 1: H I

7. MODBUS REGISTERS ADDRESSES

Table 6.1 The Modbus Register Addresses of E-AR-20

Address	Parameter	Feature	Min	Max	Explanation
14	Aor	R/W	0	3	0: 0-20, 1: 20-0, 2: 4-20, 3: 20-4
15	2Ero	R/W	0	1000	-
16	SPAn	R/W	0	1000	-
17	tCñP	R/W	0	1	0: oFF, 1: on-
18	oFSt	R/W	-100	100	-
19	AtyP	R/W	0	2	0:Type1, 1: Type2, 2: Type3
20-29	Reserved	R	-	-	-
30-221	Wood Tables	R/W	-	-	This area should be only accessed with the PC Configuration Software.

8. WARNING MESSAGES

At normal operating conditions, the upper display shows %MC but in case of a high moisture content more than 70% or a short circuit, oFL message and in case of a low moisture content less than 10 % or an open circuit, UFL message appear instead of measurement value. The lower display shows the temperature value if a temperature probe is connected, and otherwise oPEn message are shown.

9. "% MC" and RESISTANCE RELATIONSHIP

The device calculates "% MC" based on the resistance measurement method. The relationship between "% MC" and resistance is shown in **Table 9.1**.

MC% - Resistance Table			
MC%	Type 1 (Spruce)	Type 2 (Birch)	Type 3 (Douglas Fir)
	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
7.00	22.400	87.000	22.400
8.00	5.890	19.950	5.010
9.00	2.140	4.470	1.990
10.00	250	110	850
11.00	365	470	380
12.00	165	200	180
13.00	83	96	98
14.00	44	53	55
15.00	25.1	30.2	32
16.00	15.5	18.2	19
17.00	9.8	11.5	12
18.00	6.3	7.6	7.4
19.00	4.27	5.13	5.0

Table 9.1.

9. "% MC" and RESISTANCE RELATIONSHIP

MC% - Resistance Table			
MC%	Type 1 (Spruce)	Type 2 (Birch)	Type 3 (Douglas Fir)
	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
20.00	3.02	3.55	3.4
21.00	2.14	2.51	2.3
22.00	1.58	1.78	1.6
23.00	1.17	1.32	1.0
24.00	0.91	0.95	0.77
26.00	0.709	0.74	0.6
28.00	0.567	0.592	0.480
32.00	0.372	0.389	0.315
34.00	0.307	0.321	0.260
36.00	0.254	0.265	0.215
38.00	0.219	0.228	0.185
40.00	0.189	0.197	0.160
50.00	0.124	0.130	0.105
60.00	0.095	0.099	0.080
70.00	0.077	0.08	0.065

Table 9.1.

10. E-AR-20 CONFIGURATION SOFTWARE

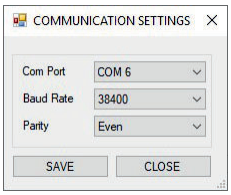
10.1. PC Connection:

Devices with RS-485 communication port can be connected to a PC using an RS232 or USB converter depending on the availability of ports on the PC. E-AR-20 Configuration Software is provided as a free tool and can perform following operation using a windows based PC interface.

- Parameter Adjustment
- Custom Resistance / MC% table download / upload

Please see connection diagram (**see Figure 6.2**) for RS-485 port connection. After connecting device to the PC with a proper converter, the user should adjust communication parameters in order to start communication. Communication parameters of the PC can be accessed from Settings → Communication settings, menu (**please see Figure 10.1**).
Comport: Serial port number to which the RS485 convert was connected.
Baud Rate, Parity: Serial communication baud rate and parity settings.

These two parameter should be same as those of the device parameters (**please see section 5.3**).
Communication address of the device must be set to 1.



10. E-AR-20 CONFIGURATION SOFTWARE

10.2. Setting Parameters and Downloading Custom Wood Tables:

The user interface is divided into two tabs for parameter settings and custom wood table downloading. PARAMETERS tab contains all the device parameters and user can adjust any parameter using parameter windows.

WOOD TABLES:
Please read the parameter explanation of ATYP in **section 5.3.**
In order to modify a table:

- First select the wood type (Available options are t IP1, t IP2 and t IP3.).
- Press **READ FROM DEVICE** to load current values.
- At these stage user has two options to change the current values. The first is to enter MC% and resistance values manually and the second is to load from a previously saved **CSV** files.
- Press **SAVE TO DEVICE** to send newly adjusted values to the device.

While entering the wood tables following precaution must be taken.
1.MC% values should be in ascending order and accordingly resistance values should be in descending order (It is the usual result of MC% and resistance relation).
2.Unused rows should be left empty. There should be no empty rows between entered valid resistance values.
3.There could be slight differences between adjusted values and those same values previously downloaded to the device. These differences do not affect the measurement result and are caused by mandatory decimation of large resistance values.

10. E-AR-20 CONFIGURATION SOFTWARE



10. E-AR-20 CONFIGURATION SOFTWARE

