Digital controller for medium-low temperature refrigeration applications
XW40L

1. GENERAL WARNING

1.1 PLEASE READ BEFORE USING THIS MANUAL
- This manual is part of the product and should be kept near the instrument for easy and quick reference.
- The instrument shall not be used for purposes different from those described hereunder. It cannot be used as a safety device.
- Check the application limits before proceeding.

1.2 ⚠ SAFETY PRECAUTIONS
- Check the supply voltage is correct before connecting the instrument.
- Do not expose to water or moisture: use the controller only within the operating limits avoiding sudden temperature changes with high atmospheric humidity to prevent formation of condensation
- Warning: disconnect all electrical connections before any kind of maintenance.
- Fit the probe where it is not accessible by the End User. The instrument must not be opened.
- In case of failure or faulty operation send the instrument back to the distributor or to "Dixell S.p.A." (see address) with a detailed description of the fault.
- Consider the maximum current which can be applied to each relay (see Technical Data).
- Ensure that the wires for probes, loads and the power supply are separated and far enough from each other, without crossing or intertwining.
- In case of applications in industrial environments, the use of mains filters (our mod. FT1) in parallel with inductive loads could be useful.

2. GENERAL DESCRIPTION

Model **XW40L**, format 38x185mm, is microprocessor based controller, suitable for applications on medium or low temperature ventilated refrigerating units. It has 3 relay outputs to control compressor, defrost, which can be either electrical or reverse cycle (hot gas) and light . It is also provided with 2 NTC probe inputs, the first one for temperature control, the second one, to be located onto the evaporator, to control the defrost termination temperature.
The HOT KEY output allows to connect the unit, by means of the external module XJ485-CX, to a network line **ModBUS-RTU** compatible such as the **dIXeLL** monitoring units of X-WEB family. It allows to program the controller by means the HOT KEY programming keyboard.
The instrument is fully configurable through special parameters that can be easily programmed through the keyboard.

3. CONTROLLING LOADS

3.1 COMPRESSOR
The regulation is performed according to the temperature measured by the thermostat probe with a positive differential from the set point: if the temperature increases and reaches set point plus differential the compressor is started and then turned off when the temperature reaches the set point value again.
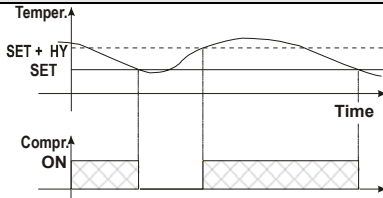
In case of fault in the thermostat probe the start and stop of the compressor are timed through parameters "**COn**" and "**COF**".

3.2 DEFROST
Two defrost modes are available through the "**tdF**" parameter: defrost through electrical heater (**tdF = EL**) and hot gas defrost (**tdF = in**). Other parameters are used to control the interval between defrost cycles (IdF), its maximum length (MdF) and two defrost modes: timed or controlled by the evaporator's probe (P2P).
At the end of defrost dripping time is started, its length is set in the FSt parameter. With FSt =0 the dripping time is disabled.

4. FRONT PANEL COMMANDS

4.1 STEEL FINISHING

SET: To display target set point; in programming mode it selects a parameter or confirm an operation.

❄ (**DEF**) To start a manual defrost

⌃ (**UP**): To see the max. stored temperature; in programming mode it browses the parameter codes or increases the displayed value.

⌄ (**DOWN**) To see the min stored temperature; in programming mode it browses the parameter codes or decreases the displayed value.

⏻ To switch the instrument off.

☀ To switch the light.

KEY COMBINATIONS:

⌃ + ⌄	To lock & unlock the keyboard.
SET + ⌄	To enter in programming mode.
SET + ⌃	To return to the room temperature display.

4.2 USE OF LEDS
Each LED function is described in the following table.

LED	MODE	FUNCTION
❄	ON	Compressor enabled
❄	Flashing	Anti-short cycle delay enabled
❄	ON	Defrost enabled
❄	Flashing	Drip time in progress
(!)	ON	An alarm is occurring
❄	ON	Continuous cycle is running
☾	ON	Energy saving enabled
☀	ON	Light on
°C/°F	ON	Measurement unit
°C/°F	Flashing	Programming phase

5. MAX & MIN TEMPERATURE MEMORIZATION

5.1 HOW TO SEE THE MIN TEMPERATURE
1. Press and release the ⌄ key.
2. The "Lo" message will be displayed followed by the minimum temperature recorded.
3. By pressing the ⌄ key again or by waiting 5s the normal display will be restored.

5.2 HOW TO SEE THE MAX TEMPERATURE
1. Press and release the ⌃ key.
2. The "Hi" message will be displayed followed by the maximum temperature recorded.
3. By pressing the ⌃ key again or by waiting 5s the normal display will be restored.

5.3 HOW TO RESET THE MAX AND MIN TEMPERATURE RECORDED
1. Hold press the SET key for more than 3s, while the max. or min temperature is displayed. (rSt message will be displayed)
2. To confirm the operation the "rSt" message starts blinking and the normal temperature will be displayed.

6. MAIN FUNCTIONS

6.1 HOW TO SEE THE SET POINT
SET 👉
1. Push and immediately release the **SET** key: the display will show the Set point value;
2. Push and immediately release the **SET** key or wait for 5 seconds to display the probe value again.

6.2 HOW TO CHANGE THE SET POINT
1. Push the **SET** key for more than 2 seconds to change the Set point value;
2. The value of the set point will be displayed and the "**°C" or "°F**" LED starts blinking;
3. To change the Set value push the ⌃ or ⌄ arrows within 10s.
4. To memorise the new set point value push the **SET** key again or wait 10s.

6.3 HOW TO START A MANUAL DEFROST
👉❄ Push the **DEF** key for more than 2 seconds and a manual defrost will start.

6.4 HOW TO CHANGE A PARAMETER VALUE
To change the parameter's value operate as follows:
1. Enter the Programming mode by pressing the **Set** + ⌄ keys for 3s (the "**°C" or "°F**" LED starts blinking).
2. Select the required parameter. Press the "**SET**" key to display its value
3. Use "**UP**" or "**DOWN**" to change its value.
4. Press "**SET**" to store the new value and move to the following parameter.
To exit: Press SET + UP or wait 15s without pressing a key.
NOTE: the set value is stored even when the procedure is exited by waiting the time-out to expire.

6.5 THE HIDDEN MENU
The hidden menu Includes all the parameters of the instrument.
6.5.1 HOW TO ENTER THE HIDDEN MENU
1. Enter the Programming mode by pressing the **Set** + ⌄ keys for 3s (the "**°C" or "°F**" LED starts blinking).
2. Released the keys, then push again the Set+ ⌄ keys for more than 7s. The Pr2 label will be displayed immediately followed from the HY parameter.
   NOW YOU ARE IN THE HIDDEN MENU.
3. Select the required parameter.
4. Press the "**SET**" key to display its value
5. Use ⌃ or ⌄ to change its value.
6. Press "**SET**" to store the new value and move to the following parameter.
To exit: Press SET + ⌃ or wait 15s without pressing a key.
NOTE1: if none parameter is present in Pr1, after 3s the "noP" message is displayed. Keep the keys pushed till the Pr2 message is displayed.
NOTE2: the set value is stored even when the procedure is exited by waiting the time-out to expire.

6.5.2 HOW TO MOVE A PARAMETER FROM THE HIDDEN MENU TO THE FIRST LEVEL AND VICEVERSA.

Each parameter present in the HIDDEN MENU can be removed or put into "THE FIRST LEVEL" (user level) by pressing **"SET + ⌄"**.
In HIDDEN MENU when a parameter is present in First Level the decimal point is on.

6.6 HOW TO LOCK THE KEYBOARD

1. Keep pressed for more than 3 s the **UP + DOWN** keys.
2. The "POF" message will be displayed and the keyboard will be locked. At this point it will be possible only to see the set point or the MAX o Min temperature stored
3. If a key is pressed more than 3s the "POF" message will be displayed.

6.7 TO UNLOCK THE KEYBOARD

Keep pressed together for more than 3s the ▲ and ⌄ keys, till the **"Pon"** message will be displayed.

6.8 THE CONTINUOUS CYCLE

When defrost is not in progress, it can be activated by holding the " ▲ " key pressed for about 3 seconds. The compressor operates to maintain the "**ccS**" set point for the time set through the "**CCt**" parameter. The cycle can be terminated before the end of the set time using the same activation key " ▲ " for 3 seconds.

6.9 THE ON/OFF FUNCTION

With "**onF = oFF**", pushing the **ON/OFF** key, the instrument is switched off. The **"OFF"** message is displayed. In this configuration, the regulation is disabled.
To switch the instrument on, push again the ON/OFF key.

WARNING: Loads connected to the normally closed contacts of the relays are always supplied and under voltage, even if the instrument is in stand by mode.

7. PARAMETERS

REGULATION

Hy Differential: (0,1 ÷ 25,5°C / 1÷255 °F) Intervention differential for set point. Compressor Cut IN is Set Point + differential (Hy). Compressor Cut OUT is when the temperature reaches the set point.
LS Minimum set point: (- 50°C÷SET/-58°F÷SET): Sets the minimum value for the set point.
US Maximum set point: (SET÷110°C/ SET÷230°F). Set the maximum value for set point.
Ot Thermostat probe calibration: (-12.0÷12.0°C; -120÷120°F) allows to adjust possible offset of the thermostat probe.
P2P Evaporator probe presence: n= not present: the defrost stops by time; **y=** present: the defrost stops by temperature.
OE Evaporator probe calibration: (-12.0÷12.0°C; -120÷120°F). allows to adjust possible offset of the evaporator probe.
OdS Outputs activation delay at start up: (0÷255min) This function is enabled at the initial start up of the instrument and inhibits any output activation for the period of time set in the parameter.
AC Anti-short cycle delay: (0÷50 min) minimum interval between the compressor stop and the following restart.
CCt Compressor ON time during continuous cycle: (0.0÷24.0h; res. 10min) Allows to set the length of the continuous cycle: compressor stays on without interruption for the CCt time. Can be used, for instance, when the room is filled with new products.
CCS Set point for continuous cycle: (-50÷150°C) it sets the set point used during the continuous cycle.
COn Compressor ON time with faulty probe: (0÷255 min) time during which the compressor is active in case of faulty thermostat probe. With COn=0 compressor is always OFF.
COF Compressor OFF time with faulty probe: (0÷255 min) time during which the compressor is OFF in case of faulty thermostat probe. With COF=0 compressor is always active.

DISPLAY

CF Temperature measurement unit: **°C=**Celsius; **°F=**Fahrenheit. WARNING: When the measurement unit is changed the SET point and the values of the parameters Hy, LS, US, Ot, ALU and ALL have to be checked and modified if necessary).
rES Resolution (for °C): (in = 1°C; dE = 0.1 °C) allows decimal point display.

DEFROST

tdF Defrost type: EL = electrical heater; in = hot gas
dtE Defrost termination temperature: (-50÷50 °C/ -58÷122°F) (Enabled only when EdF=Pb) sets the temperature measured by the evaporator probe, which causes the end of defrost.
IdF Interval between defrost cycles: (0÷120h) Determines the time interval between the beginning of two defrost cycles.
MdF (Maximum) length for defrost: (0÷255min) When **P2P = n**, (not evaporator probe: timed defrost) it sets the defrost duration, when **P2P = y** (defrost end based on temperature) it sets the maximum length for defrost.
dFd Temperature displayed during defrost: (**rt** = real temperature; **it** = temperature at defrost start; **SEt** = set point; **dEF** = "deF" label):
dAd MAX display delay after defrost: (0÷255min). Sets the maximum time between the end of defrost and the restarting of the real room temperature display.
Fdt Drip time: (0÷120 min) time interval between reaching defrost termination temperature and the restoring of the control's normal operation. This time allows the evaporator to eliminate water drops that might have formed due to defrost.
dPo First defrost after start-up: (y = immediately; n = after the IdF time)
dAF Defrost delay after continuous cycle: (0÷23.5h) time interval between the end of the fast freezing cycle and the following defrost related to it.

ALARMS

ALC Temperature alarms configuration: (Ab; rE)
  Ab= absolute temperature: alarm temperature is given by the ALL or ALU values. **rE** = temperature alarms are referred to the set point. Temperature alarm is enabled when the temperature exceeds the "SET+ALU" or "SET-ALL" values.
ALU MAXIMUM temperature alarm: (SET÷110°C; SET÷230°F) when this temperature is reached the alarm is enabled, after the "ALd" delay time.

ALL Minimum temperature alarm: (-50.0 ÷ SET °C; -58÷230°F when this temperature is reached the alarm is enabled, after the "ALd" delay time.
ALd Temperature alarm delay: (0÷255 min) time interval between the detection of an alarm condition and alarm signalling.
dAO Exclusion of temperature alarm at start-up: (from 0.0 min to 23.5h) time interval between the detection of the temperature alarm condition after instrument power on and alarm signalling.

OTHER

Adr Serial address (1÷244): Identifies the instrument address when connected to a ModBUS compatible monitoring system.
rEL Software release for internal use**.**
Ptb Parameter table code: readable only**.**

8. TTL SERIAL LINE – FOR MONITORING SYSTEMS

The TTL serial line, available through the HOT KEY connector, allows by means of the external TTL/RS485 converter, **XJ485-CX**, to connect the instrument to a monitoring system **ModBUS-RTU** compatible such as the X-WEB500/3000/300.

9. X-REP OUTPUT – OPTIONAL

As optional, an X-REP can be connected to the instrument, trough the dedicated connector.

To connect the X-REP to the instrument the following connectors must be used CAB/REP1(1m), CAB/REP2 (2m), CAB/REP5 (5m),

10. INSTALLATION AND MOUNTING

The controller **XW40L**, shall be mounted on vertical panel, in a 150x31 mm hole, and fixed using two screws ⌀ 3 x 2mm. To obtain an IP65 protection grade use the front panel rubber gasket (mod. RG-L). The temperature range allowed for correct operation is 0 - 60 °C. Avoid places subject to strong vibrations, corrosive gases, excessive dirt or humidity. The same recommendations apply to probes. Let the air circulate by the cooling holes.

10.1 CUT OUT

$165 \, ^{+1}_{-1}$
$150 \, ^{+0.5}_{-0}$
$31 \, ^{+0.5}_{-0}$
Ø3 x2
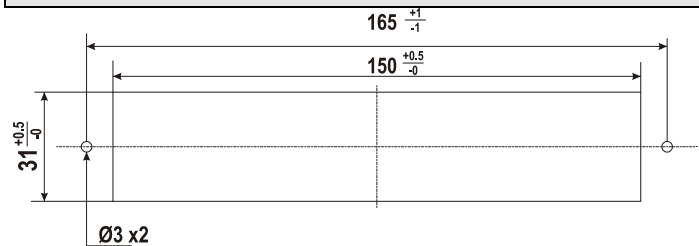
10.2 STEEL FINISHING MOUNTING

RG-LX gascke (optional)
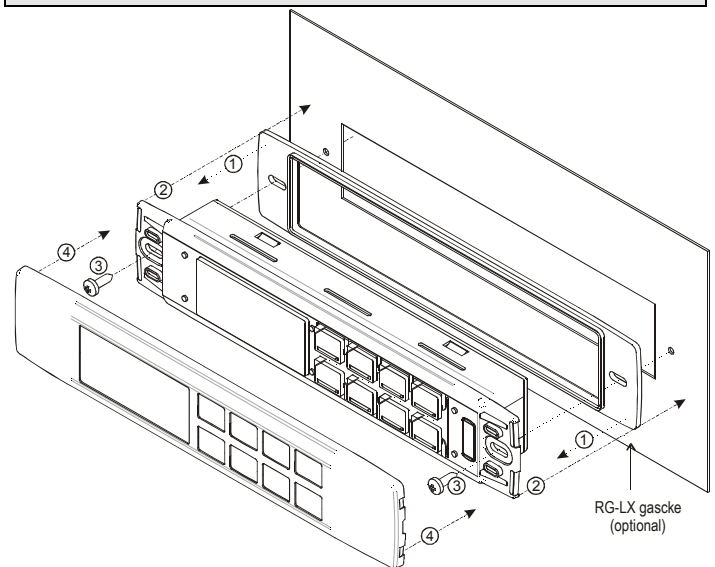
11. ELECTRICAL CONNECTIONS

The instruments are provided with screw terminal block to connect cables with a cross section up to 2,5 mm² for the digital and analogue inputs. Relays and power supply have a Faston connection (6,3mm). Heat-resistant cables have to be used. Before connecting cables make sure the power supply complies with the instrument's requirements. Separate the probe cables from the power supply cables, from the outputs and the power connections. Do not exceed the maximum current allowed on each relay, in case of heavier loads use a suitable external relay.
N.B. Maximum current allowed for all the loads is 20A.

11.1 PROBE CONNECTION

The probes shall be mounted with the bulb upwards to prevent damages due to casual liquid infiltration. It is recommended to place the thermostat probe away from air streams to correctly measure the average room temperature. Place the defrost termination probe among the evaporator fins in the coldest place, where most ice is formed, far from heaters or from the warmest place during defrost, to prevent premature defrost termination.

12. HOW TO USE THE HOT KEY

12.1 HOW TO PROGRAM A HOT KEY FROM THE INSTRUMENT (UPLOAD)

1. Program one controller with the front keypad.
2. When the controller is ON, insert the "**Hot key**" and push ▲ key; the "**uPL**" message appears followed a by flashing "**End**"
3. Push "**SET**" key and the End will stop flashing.
4. Turn OFF the instrument remove the "**Hot Key**", then turn it ON again.

NOTE: the "**Err**" message is displayed for failed programming. In this case push again ▲ key if you want to restart the upload again or remove the "**Hot key**" to abort the operation.

12.2 HOW TO PROGRAM AN INSTRUMENT USING A HOT KEY (DOWNLOAD)

1. Turn OFF the instrument.
2. Insert a **programmed "Hot Key" into the 5 PIN receptacle** and then turn the Controller ON.
3. Automatically the parameter list of the "**Hot Key**" is downloaded into the Controller memory, the "**doL**" message is blinking followed by flashing "**End**".
4. After 10 seconds the instrument will restart working with the new parameters.
5. Remove the "**Hot Key**"..

NOTE the message "**Err**" is displayed for failed programming. In this case turn the unit off and then on if you want to restart the download again or remove the "**Hot key**" to abort the operation.

13. ALARM SIGNALS

Message	Cause	Outputs
"P1"	Room probe failure	Compressor output acc. to par. "Con" and "COF"
"P2"	Evaporator probe failure	Defrost end is timed
"HA"	Maximum temperature alarm	Outputs unchanged.
"LA"	Minimum temperature alarm	Outputs unchanged.

13.1 ALARM RECOVERY

Probe alarms **P1**", "**P2**", start some seconds after the fault in the related probe; they automatically stop some seconds after the probe restarts normal operation. Check connections before replacing the probe. Temperature alarms "**HA**", "**LA**" automatically stop as soon as the temperature returns to normal values.

13.2 OTHER MESSAGES

Pon	Keyboard unlocked.
PoF	Keyboard locked
noP	**In programming mode**: none parameter is present in Pr1 **On the display** or in dP2, dP3, dP4: the selected probe is nor enabled

14. TECHNICAL DATA

Housing: self extinguishing ABS.
Case: facia 38x185 mm; depth 76mm
Mounting : panel mounting in a 150x31 mm panel cut-out with two screws. ∅ 3 x 2mm.
  Distance between the holes 165mm
Protection: IP20; **Frontal protection:** IP65 with frontal gasket mod RG-L. (optional)
Connections: Screw terminal block ≤ 2,5 mm² heat-resistant wiring and 6,3mm Faston
Power supply: 230Vac or. 110Vac or 24Vac ± 10%
Power absorption: 5VA max.
Display: 3 digits, 14,2 mm high; **Inputs**: 2 NTC probes.
Relay outputs: *Total current on loads MAX. 20A*
  compressor: relay SPST 16(3)A, 250Vac
  light: relay SPST 8 or 16(3) A, 250Vac
  defrost: relay SPST 16(3) A, 250Vac
Other output : buzzer (optional)
Serial output : TTL standard; **Communication protocol:** Modbus - RTU
Data storing: on the non-volatile memory (EEPROM).
Kind of action: 1B; **Pollution grade:** 2;**Software class:** A.;
Rated impulsive voltage: 2500V; **Over voltage Category**: II
Operating temperature: 0÷60 °C; **Storage temperature:** -30÷85 °C.
Relative humidity: 20÷85% (no condensing)
Measuring and regulation range: NTC probe: -40÷110°C (-40÷230°F);
Resolution: 0,1 °C or 1°C or 1 °F (selectable); **Accuracy (ambient temp. 25°C)**: ±0,7 °C ±1 digit

15. CONNECTIONS

Supply: 120Vac or 24Vac: connect to terminals 7-8
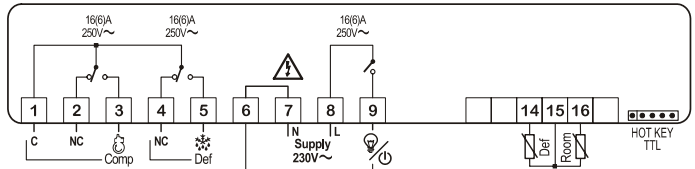
16. DEFAULT SETTING VALUES

Label	Name	Range	Value	Level
Set	Set point	LS÷US	0	---
Hy	Differential	0,1÷25.5°C/ 1÷ 255°F	4	Pr1
LS	Minimum set point	-50°C÷SET/-58°F÷SET	-2	Pr2
US	Maximum set point	SET÷110°C/ SET ÷ 230°F	16	Pr2
Ot	Thermostat probe calibration	-12÷12°C /-120÷120°F	0	Pr2
P2P	Evaporator probe presence	n=not present; Y=pres.	Y	Pr2
OE	Evaporator probe calibration	-12÷12°C /-120÷120°F	0	Pr2
OdS	Outputs delay at start up	0÷255 min	1	Pr2
AC	Anti-short cycle delay	0 ÷ 50 min	1	Pr2
CCt	Continuous cycle duration	0.0÷24.0h	0.0	Pr2
CCS	Set point for continuous cycle	(-55.0÷150,0°C) (-67÷302°F)	0	Pr2
COn	Compressor ON time with faulty probe	0 ÷ 255 min	15	Pr2
COF	Compressor OFF time with faulty probe	0 ÷ 255 min	20	Pr2
CF	Temperature measurement unit	°C ÷ °F	°C	Pr1
rES	Resolution	in=integer; dE= dec.point	in	Pr2
tdF	Defrost type	EL=el. heater; in= hot gas	EL	Pr2
dtE	Defrost termination temperature	-50 ÷ 50 °C	8.0	Pr1
IdF	Interval between defrost cycles	1 ÷ 120 ore	4	Pr1
MdF	(Maximum) length for defrost	0 ÷ 255 min	60	Pr1
dFd	Displaying during defrost	rt, it, SEt, DEF	it	Pr2
dAd	MAX display delay after defrost	0 ÷ 255 min	30	Pr2
Fdt	Draining time	0÷120 min	0	Pr2
dPo	First defrost after start-up	n=after IdF; y=immed.	n	Pr2
dAF	Defrost delay after fast freezing	0 ÷ 23h e 50'	0.0	Pr2
ALc	Temperat. alarms configuration	rE= related to set; Ab = absolute	rE	Pr2
ALU	MAXIMUM temperature alarm	Set÷110.0°C; Set÷230°F	10	Pr2
ALL	Minimum temperature alarm	-50.0°C÷Set/ -58°F÷Set	10	Pr2
ALd	Temperature alarm delay	0 ÷ 255 min	10	Pr2
dAO	Delay of temperature alarm at start up	0 ÷ 23h e 50'	2.0	Pr2
Adr	Serial address	1÷247	1	Pr2
rEL	Software release	--	1.8	Pr2
Ptb	Map code	--		Pr2