LX3V-4TC

User manual

Website: http://www.we-con.com.cn/en
Technical Support: support@we-con.com.cn
Skype: fcwkkj
Phone: 86-591-87868869
QQ: 1043098682
Technical forum: http://wecon.freeforums.net/

1. Introduction

The LX3V-4TC expansion module amplifies the signal from four thermocouple sensors (Type K or J) and converts the data into 12 bit reading's stored in the main unit. Both Centigrade (°C) and Fahrenheit (°F) can be read.

Reading resolution is 0.2°C/0.72°F of Type K and 0.3°C/0.54°F of Type J.

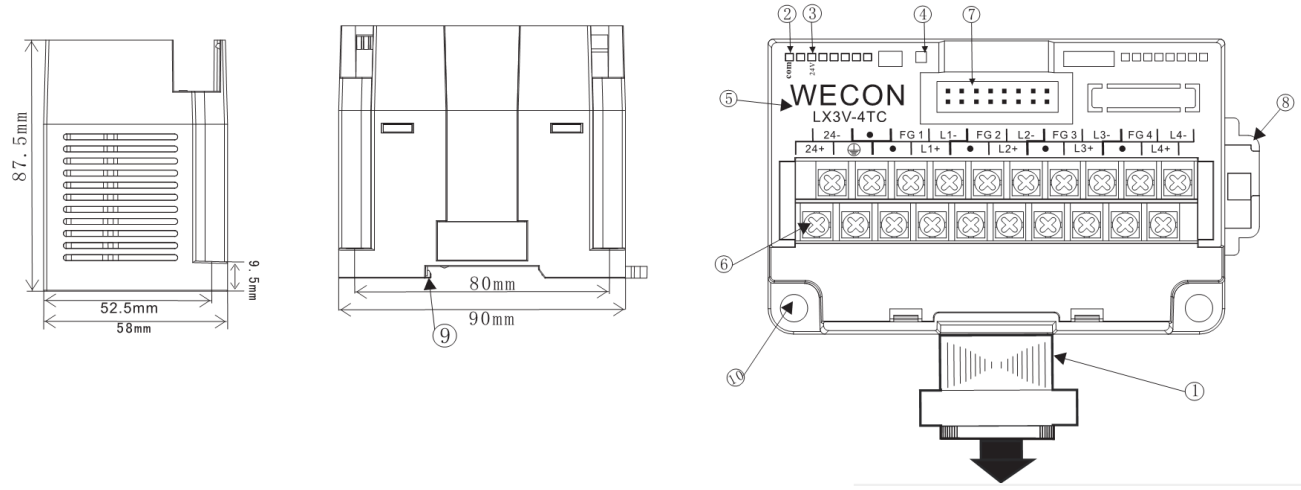
All data transfers and parameter settings are adjusted via software control of the LX3V-4TC; by use of the TO/FROM applied instructions in the PLC.

LX3V-4TC consumes 5V voltage from LX3V main unit or active extension unit, 90mA current of power supply. Thermocouples with the following specifications can be used: Type K, Type J.

2. External dimensions

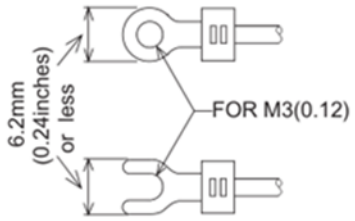
Weight: Approx 0.3kg (0.661bs)

Dimensions: mm



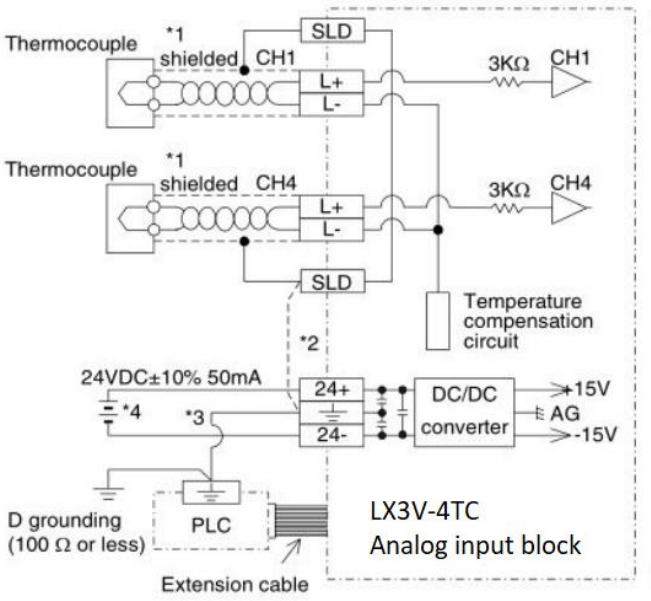
①Extension cable and connector
②Com LED: Light when communicating
③Power LED: Light when connect to 24V
④State LED: Light when normal condition
⑤Module name
⑥Analog signal output terminal
⑦Extension module interface
⑧DIN rail mounting slot
⑨DIN rail hook
⑩Mounting holes (ϕ4.5)

Using crimp terminations



- Be sure to use the crimp-style terminals that satisfy the dimensional requirements shows in the left figure.
- Apply 0.5 to 0.8 N.m (5 to 8 kgf.cm) torque to tighten the terminals to prevent abnormal operation.

3. Terminal Layouts



1) The compensating cables that can be used for connecting with the thermocouple are the following.
   Type K: KX-G, KX-GS, KX-H, KX-HS, WX-G, WX-H, VX-G
   Type J: JX-G, JX-H
   For every 10Ω of line resistance, the compensating cable will indicate a temperature 0.12°C higher than actual.
   Check the line resistance before using.
   Long compensating cables are more prone to noise interference, therefore a short (less than 100m) compensating cable is recommended.

Unused channels should have a wire link connected between the + and – terminals to prevent an errors being detected on that channel.

2) If there is excessive electrical noise, connect the FG terminal to the ground terminal on the unit.
3) Connect the ground terminals of the LX3V-4TC module and the PLC. Use grounding on the PLC.
4) The 24V DC built-in supply of the PLC may be used as the power supply.

4. Installation notes and usage

4.1 Environmental specification

Item	Specification

Environmental specifications (excluding following)	Same as those for the LX3V base unit
Dielectric withstand voltage	500V AC, 1min (between all terminals and ground)

4.2 Power supply specification

Item	Description
Analog circuits	±24V DC±10%,55mA
Digital circuits	5V DC,90mA(internal power supply from base unit)

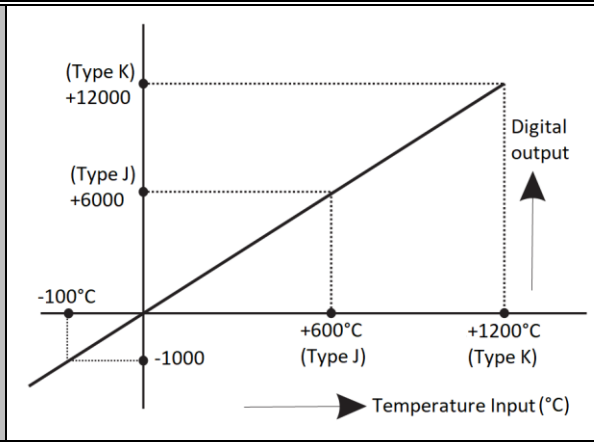
4.3 Performance specification

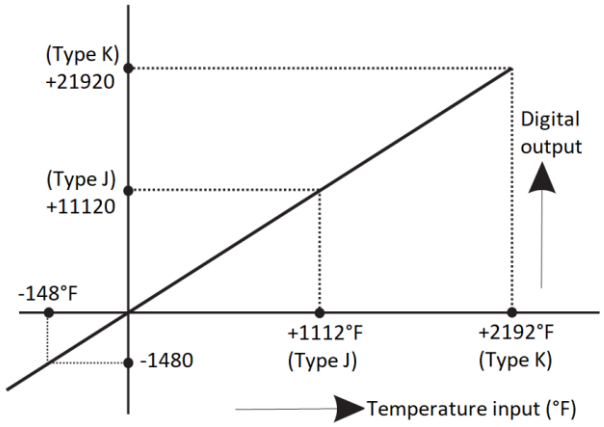
Item	Centigrade		Fahrenheit	
	Both °C and °F readings are available by reading the appropriate buffer memory area.			
Analog input signal	Thermocouple: Type K or J (either can be used for each channel), 4 channels.			
Rated temperature range	Type K	-100°C to 1200°C	Type K	-148°F to +2192°F
	Type J	-100°C to 600°C	Type J	-148°F to +1112°F
Digital output	Type K	-1000 to 12000	Type K	-1480 to 21920
	Type J	-1000 to 6000	Type J	-1480 to 11120
	12-bit conversion ,save as complement of 2 in 16 bits			
Resolution	Type K	0.4°C	Type K	0.72°F
	Type J	0.3°C	Type J	0.54°F
Overall accuracy	±5% full scale + 1°C Freezing point of pure water 0°C / 32°F			
Conversion speed	(240ms ± 2%) × 4 channels (unused channels are not converted)			

Note: Earth-tipped thermocouples are not suitable for use with this module.

Analog input

Feature	Conversion





Miscellaneous

Item	Description
Isolation	Photo-coupler isolation between analog and digital circuits. DC/DC converter isolation of power from LX3V MPU. No isolation between analog channels.
Total points	8 points taken from the LX3V expansion bus (can be either inputs or outputs)

4.4 Buffer memory

BFM	Description
*#0	Thermocouple Type K or J selection mode. At shipment: H0000
*#1→ #4	CH1 to CH4 Averaged temperature reading to be averaged (1 to 4,096) Default = 8
*#5→ #8	CH1 to CH4 Averaged temperature in 0.1°C units
*#9→ #12	CH1 to CH4 Present temperature in 0.1°C units
*#13→ #16	CH1 to CH4 Averaged temperature in 0.1°F units
*#17→ #20	CH1 to CH4 Present temperature in 0.1°F units
*#21→ #27	Reserved
*#28	Digital range error latch
#29	Error status
#30	Identification code K2030
#31	Software version

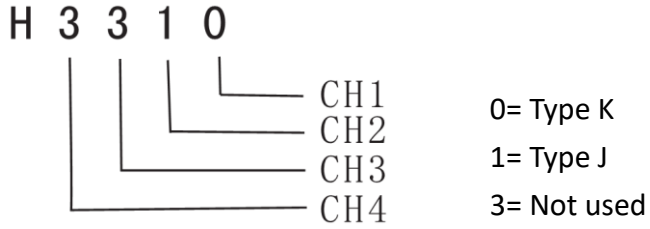
- The LX3V-4TC module communicates with the PLC via buffer memories.

- BFMs #21 to #27 and #31 are reserved. All non-reserved BFMs can be read by the PLC using the FROM instruction.
- BFMs (buffer memories) marked with an "*" can be written to, the special function block using the TO instruction.

1) Buffer Memory BFM #0: Thermocouple Type K or J selection mode

BFM #0 is used to select Type K or J thermocouples for each channel. Each digit of a 4 digit hexadecimal number corresponds to one channel, the least significant digit being channel 1.

Example



- A/D conversion time is 240ms per channel. When "3" (unused) is set for a channel, A/D conversion is not executed for that channel, therefore, the total conversion time is decreased. In the above example, the conversion time is as follows:
  240ms (conversion time per channel) × 2channels (number of channels used) = 480ms (total conversion time)

2) Buffer Memory BFMs #1 to #4: Number of temperature readings to be averaged

When the number of temperature readings to be averaged is specified for BFMs #1 to #4, the averaged data is stored in BFMs #5 to #8 (°C) and #13 to #16 (°F). Only the range 1 to 256 is valid for the number of temperature readings to be averaged. If a value outside of this range is entered, a default value of 8 is used.

3) **Buffer Memory BFMs #9 to #12 and #17 to #20: Present temperature**

These BFMs store the present value of the input data. This value is stored in units of 0.1°C or 0.1°F, but the resolution is only 0.4°C or 0.72°F for Type K and 0.3°C or 0.54°F for Type J.

4.5 States information

1) Buffer memory BFM#28: Digital range error latch

BFM #29 b10 (digital range error) is used to judge whether the measured temperature is within the unit's range or not.

BFM #28 latches the error status of each channel and can be used to check for thermocouple

disconnection.

b15 or b8	b7	b6	b5	b4	b3	b2	b1	b0
Not used	High	Low	High	Low	High	Low	High	Low
	CH4		CH3		CH2		CH1	

Low: Latches ON when temperature measurement data goes below the lowest temperature measurement limit.
High: Turns ON when temperature measurement data goes above the highest temperature measurement limit, or when a thermocouple is disconnected.

When an error occur the temperature data before the error is latched. If the measured value returns to within valid limits the temperature data returns to normal operation. (Note: The error remains latched in (BFM #28))

An error can be cleared by writing K0 to BFM #28 using the TO instruction or turning off the power.

2) Buffer memory BFM#29: Error states

BFM#29 Bit device	ON	OFF
b0: Error	When any of b1 to b3 is ON A/D conversation is stopped for the error channel	No error
b1: Reserved	Reserved	Reserved
b2: Power source	24V DC power supply failure	Power supply normal
b3: Hardware error	A/D converter or other hardware failure	Hardware normal
b4 to b9: Reserved	Reserved	Reserved
b10: Digital range error	Digital output/analog input value is outside the specified range.	Digital output value is normal
b11: Averaging error	Selected number of averaged results is outside the available range. See BFM#1 to #4	Averaging is normal (between 1 to 256)
b12 to b15: Reserved	Reserved	Reserved

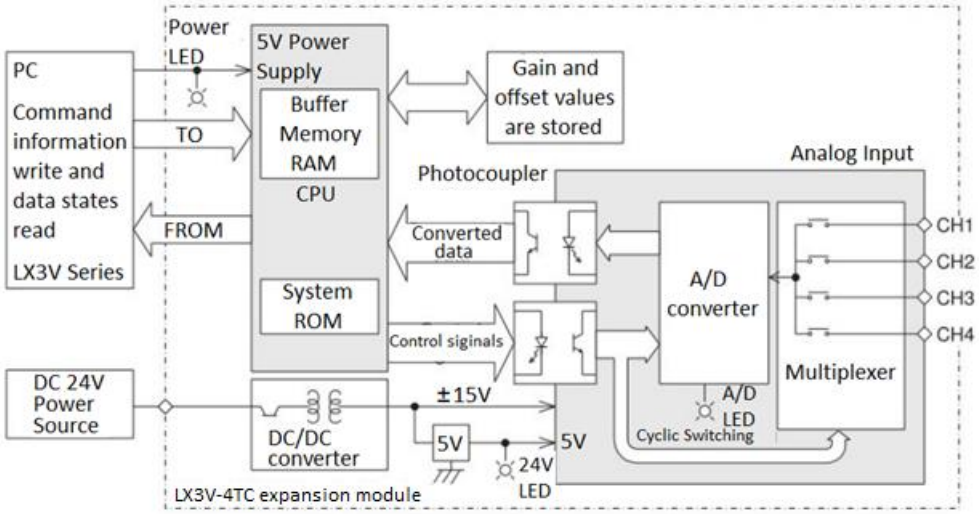
3) Identification Code Buffer Memory BFM #30

The identification code or ID number for module is read from buffer memory BFM #30 using the FROM command.

This number for the LX3V-4TC unit is K2030.

The PLC can use this facility in its program to identify the expansion module before commencing data transfer from and to the expansion module.

5. System block diagram

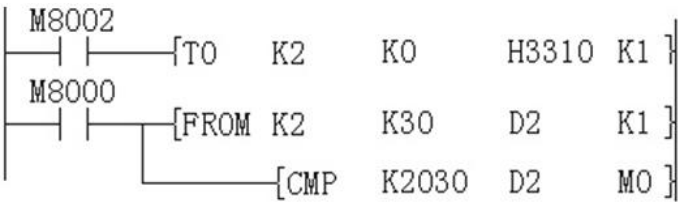


6. Example

In the program shown below, the LX3V-4TC occupies the position of special block number 2 (that is the third closest block to the PLC). A Type K thermocouple is used on CH1 and a Type J on CH2. CH3 and CH4 are not used. The averaging count is four. The averaged values in degrees C of input channels CH1 and CH2 stored respectively in data registers D0 and D3.

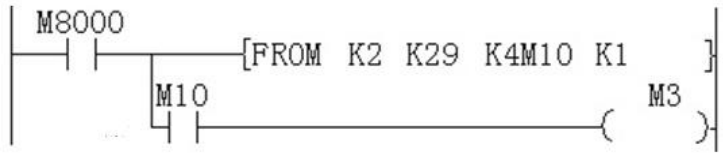
1) Example 1

This initial step checks that the special function block placed at position 2 is actually an LX3V-4TC, i.e. its unit identification number is 2030 (BFM #30). This step is optional, but it provides a software check that the system has been configured correctly.



- Specify the type of thermocouple, H3310 -> Block No.2 BFM#0. CH3 & CH4 are not used; CH2: Type J (1); CH1: Type K (0);
- Block No.2 BFM#30->(D2) identification code;
- When (K2030)= (D2), M1=ON. i.e. when identification code is K2030, M1=ON.

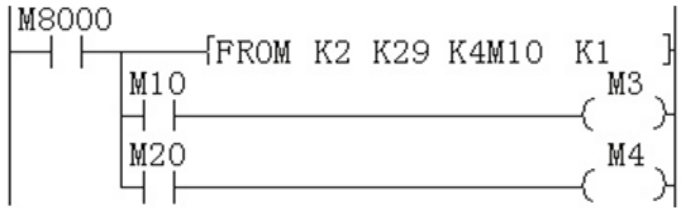
2) Example 2



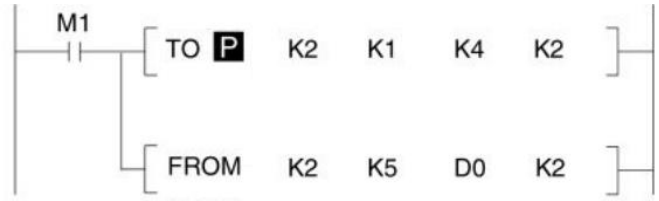
Transfer the error status to (M25 to M10), when error is found, M10=ON

This step provides optional monitoring of the LX3V-4TC Error Buffer Memory (#29). If there is an Error on the LX3V-4TC, bit b0 of BFM #29 will be set on. This can be read by this program step, and output as a bit device in the PLC (Y010 in this example). Additional Error devices can be output in a similar manner, e.g. b10 BFM #29 Digital range error. (see example 3)

3) Example 3



M10 represents b0 of BFM#29
M20 represents b10 of BFM#29

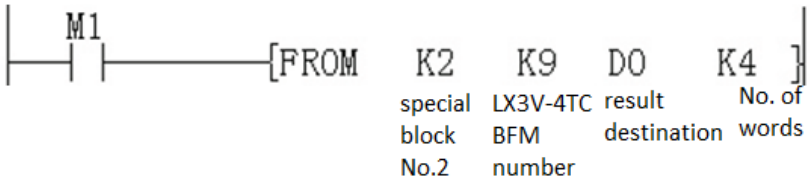


- (K4)-> (BFM#1), (K4)-> (BFM#2). Number of samples is changed to 4 on both CH1 and CH2.
- (BFM#5)-> (D0), (BFM#6)-> (D1). Transfer the average temperature value in °C to the data registers.

This step is the actual reading of the LX3V-4TC input channels. It is essentially the only program step which is needed. The "TO" instruction in this example, sets the input channels, CH1 and

CH2, to take the average reading of four samples.

The "FROM" instruction reads the average temperatures (BFM #5 to #8) for input channels CH1 and CH2 of the LX3V-4TC. If direct temperature readings are required BFM #9 and #10 should be read instead, e.g.



7. Diagnostics

7.1 Preliminary checks

1) Check whether the input wiring and/or extension cables are properly connected on LX3V-4TC analog special function block.
2) Check that the LX3V system configuration rules have not been broken, i.e. the number of special function blocks does not exceed 16 and the total system I/O is equal or less than 256 I/O.
3) Ensure that the correct operating range has been selected for the application.
4) Check that there is no power overload on either the 5V or 24V power sources, remember the loading on a LX3V main unit or a powered extension unit varies according to the number of extension blocks or special function blocks connected.
5) Put the LX3V main unit into RUN.

7.2 Error checking

- If the LX3V-4TC special function block does not seem to operate normally, check the following items.
  Check the status of the POWER LED.
  Lit: The extension cable is properly connected.
  Otherwise: Check the connection of the extension cable.
- Check the external wiring.
- Check the status of the “24V” LED (top right corner of the LX3V-4TC).

Lit: LX3V-4TC is OK; 24V DC power source is OK.

Otherwise: Possible 24VDC power failure, if OK possible LX3V-4TC failure.

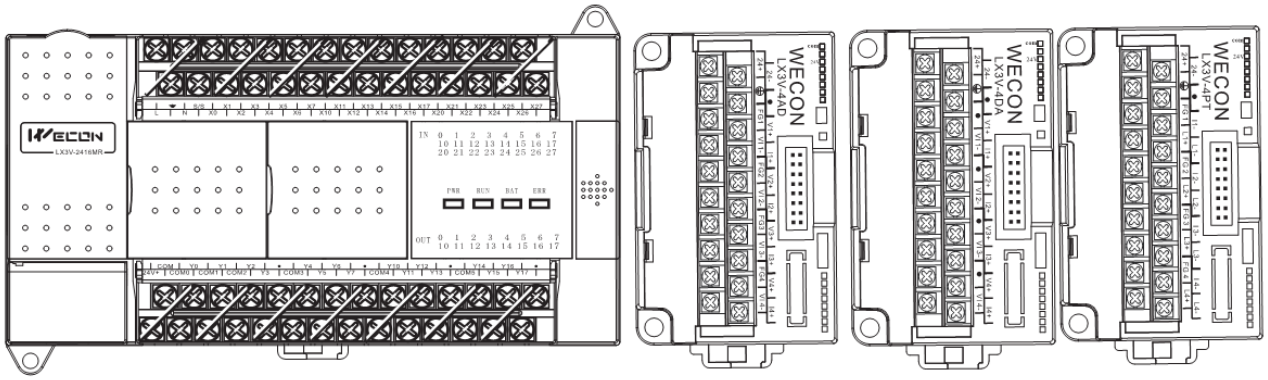
- Check the status of the “A/D” LED (top right corner of the LX3V-4TC).

  Lit: A/D conversion is proceeding normally.

  Otherwise: Check buffer memory #29 (error status). If any bits (b2 and b3) are ON, then this is why the A/D LED is OFF.

7.3 Checking special function block numbers

Other special units of blocks that use FROM/TO commands, such as analog input blocks, analog output blocks and high-speed counter blocks, can be directly connected to the base unit of the LX3V programmable controller or to the right side of other extension blocks or units. Each special block is consecutively numbered from 0 to 15 beginning from the one closest to the base unit. A maximum of 16 special blocks can be connected.



Special units of blocks

8. EMC considerations

- Electromagnetic compatibility or EMC must be considered before using the LX3V-4TC.
- WECON recommends that the thermocouple sensors used, should be fitted with a form of seild or screening as protection against EMC noise.
- If some form of cable protection is used, the “Shield” must be terminated at the terminals as shown in chapter 3.
- Because of the delicate nature of all analog signals, failure to take good EMC precautions could lead to EMC noise induced errors; up to ±10% of actual values. This is an absolute worst case figure, users who do take good precautions can expect operation within normal tolerances. EMC considerations should include selection of good quality cables, good routing of those

cables away from potential noise sources.

- Additionally it is recommended that signal averaging is used as this will reduce the effects of random noise “spikes”