

# MLC 9000 BUS-COMPATIBLE PID CONTROL SYSTEM Installation Manual 4-Loop Controller Module 59294-1 (ECN00070)



All procedures in this Manual should be performed only by personnel competent and authorised to do so. All local and national regulations pertaining to electrical installations and safety must be rigidly observed.

## 1 INSTALLATION - MECHANICAL

### 1.1 SITE PRE-REQUISITES

#### 1.1.1 Enclosure

It is recommended that the MLC 9000 Control System - comprising a Bus Communications Module (BCM) and up to eight Loop Controller Modules (LCMs) - be installed in an enclosure which is sealed against the ingress of dust and moisture. The enclosure must contain sufficient length of 35mm Top-Hat DIN mounting rail to accommodate the system modules (see below) plus an extra 50mm of rail to permit modules to be separated. Module dimensions are shown in Figure 1.

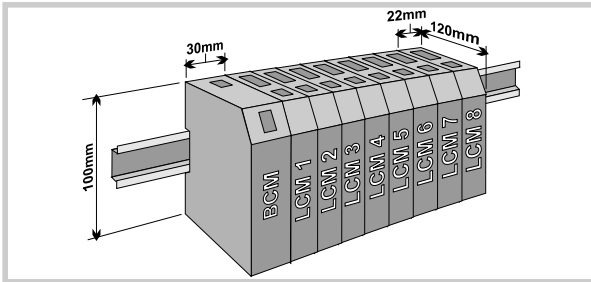


Figure 1 Main Dimensions

**NOTE:** An additional 60mm space is required above and below the Modules to allow ventilation (see below) and to accommodate wiring bend radii to enclosure trunking. During installation, keep the ventilation holes on the Loop Controller Module covered to prevent ingress of dust and moisture.



**WARNING:** The maximum of eight LCMs per system must not be exceeded. If the system is to include one or more 4-Loop LCMs (Type C46x), the BCM used must have a Product Revision Level (PRL) of **1B** or later for **B210 & B220**, **1C** or later for **B230** (see label on side of BCM).

It is recommended that some means of preventing unauthorised access to the enclosure (e.g. lockable doors) is provided.

#### 1.1.2 Ventilation

No forced ventilation or ventilation slots are required in the enclosure but temperatures within the enclosure must be within specification. All modules have ventilation slots in the top and bottom surfaces; these should not be obstructed.

### 1.2 MODULE INSTALLATION

The modules are installed onto the DIN rail in the following order:

1. Bus Communications Module
2. Interconnect Module(s)
3. First Loop Controller Module
4. Second Loop Controller Module etc.

Each LCM must be separated from its Interconnect Module before installation.



**CAUTION: HOT SWAPPING OF LOOP CONTROLLER MODULES.** Although hot swapping of LCMs is possible, caution must be exercised to eliminate the risk of receiving an electric shock due to the possibility of up to 240V AC being present at the relay terminals of an LCM. Before removing any connectors from an LCM, please ensure that all hazardous voltages have been isolated from the appropriate connectors.

### 1.2.1 Installing an Interconnect Module

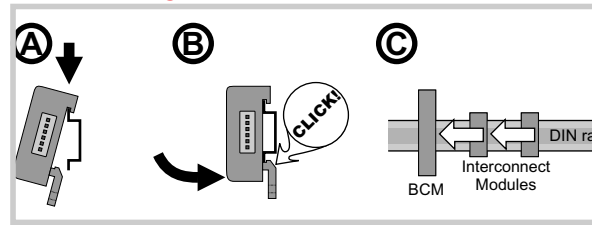


Figure 2 Installing an Interconnect Module

### 1.2.2 Installing an LCM

**NOTE:** Any LCM may be used with any Interconnect Module (i.e. the modules are not matched)

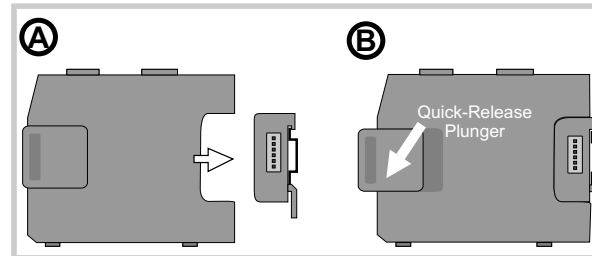


Figure 3 Installing an LCM

## 1.3 REMOVING MODULES FROM THE SYSTEM

### 1.3.1 Removing an LCM

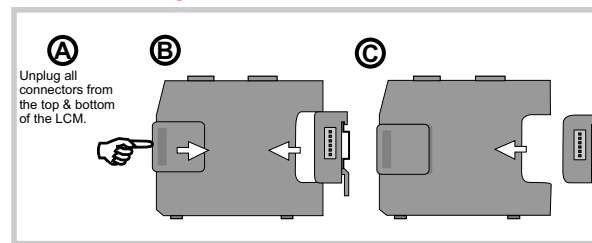


Figure 4 Removing an LCM

### 1.3.2 Removing an Interconnect Module

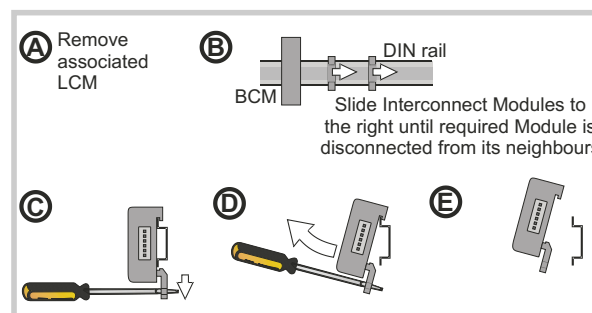


Figure 5 Removing an Interconnect Module

## 2 INSTALLATION - ELECTRICAL

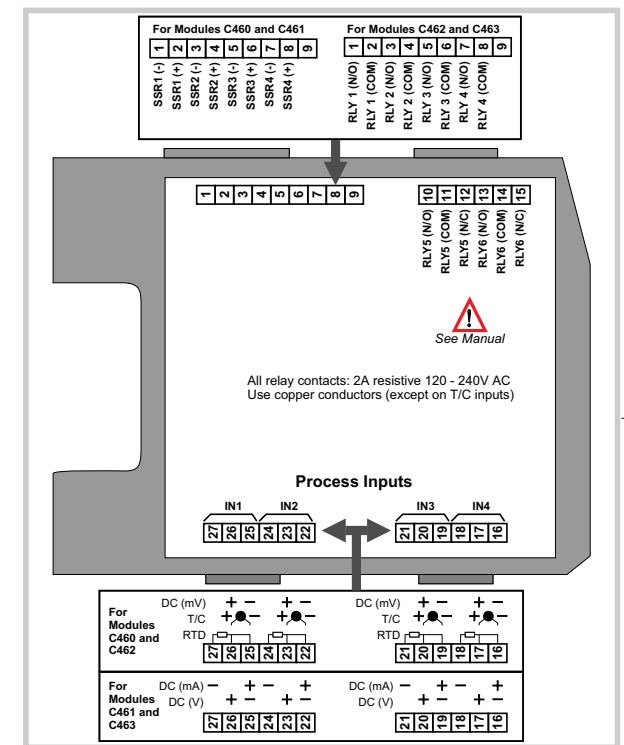


Figure 6 LCM Connectors



**CAUTION:** The system is designed for installation in an enclosure which provides adequate protection against electric shock. Local regulations regarding electrical installation and safety should be rigidly observed. Consideration should be given to prevention of access to the power terminations by unauthorised personnel.

### 2.1 THERMOCOUPLE INPUT (Modules C460 and C462)

The correct type of extension leadwire/compensation cable must be used for the entire distance between the LCM connector and the thermocouple; correct polarity must be observed throughout. Joints in the cable should be avoided. **NOTE:** Do not run cables adjacent to power-carrying conductors. If the wiring is run in a conduit, use a separate conduit for the thermocouple wiring. If the thermocouple is grounded, this must be done at one point only. If the extension lead is shielded, the shield must be grounded at one point only.

### 2.2 RTD INPUT (3-WIRE) (Modules C460 and C462)

The extension leads should be of copper and the resistance of the wires connecting the resistance element should not exceed 50Ω per lead (the leads should be of equal length and resistance).

### 2.3 LINEAR INPUT

The linear input ranges are mA, mV and V based. The Volts/mA ranges are on Modules C461 and C463. The mV range is on Modules C460 and C462.

### 2.4 RELAY OUTPUTS

Relay Outputs 1 - 4 are single pole single throw normally-open outputs (Modules C462 and C463). Relay Outputs 5 and 6 are single pole double throw outputs (all Modules C46x).

### 2.5 SSR DRIVE OUTPUTS (Modules C460 and C461)

These supply 12V DC nominal (10V DC minimum) @ 20mA maximum.

### 3 ON-SITE DIAGNOSTICS

C460		One front panel LED indicator (red/green switchable) for each loop provides basic on-site diagnostic information:
LED Colour/State	Meaning	
OFF	No power	
Green flashing (1 second ON, 3 seconds OFF)	Process Variable < Setpoint	
Green ON	Process Variable = Setpoint (on control - difference between process variable and setpoint is less than 0.1% of input span)	
Green flashing (3 seconds ON, 1 second OFF)	Process Variable > Setpoint	
Red flashing (1 second ON, 1 second OFF)	No communication with BCM.	
Red fast flashing (0.5 seconds ON, 0.5 seconds OFF)	Auto-addressing is complete but the LCM is inhibited i.e. configuration may be incomplete.	
Red ON	An alarm is active.	
Orange (green and red simultaneously)	Hardware fault detected.	

**NOTE:** An active alarm will over-ride a continuous-green indication; in the case of a flashing green state, indication of an active alarm will appear during the OFF time intervals (i.e. indicator will flash alternate green/red).

### 4 MODULE SPECIFICATION

GENERAL	
Function:	Each LCM performs the control functions and provides the input and output connections for its own control loops. Four process inputs (temperature or DC) and four SSR Drive or relay (SPST) outputs are provided, along with two relay (SPDT) outputs.
Types available:	<b>C460:</b> Four temperature/mV process inputs, four SSR drive outputs, two SPDT relay outputs. <b>C461:</b> Four DC process inputs, four SSR drive outputs, two SPDT relay outputs. <b>C462:</b> Four temperature/mV process inputs, four SPST relay outputs, two SPDT relay outputs. <b>C463:</b> Four DC process inputs, four SPST relay outputs, two SPDT relay output.
Process Input:	Type and scale user-selectable (see below). Sample rate = 10/second. <b>Temperature process inputs:</b> T/C, RTD, and DC (mV) are available. <b>DC process inputs:</b> DC (V) or DC (mA) ranges are available.
Outputs:	Outputs 1 - 4: SPST Relay or SSR Drive Outputs 5 and 6: SPDT Relay

PROCESS INPUT			
Types available (Range Minimum - Range Maximum)			
Thermocouple (T/C)		RTD	DC Linear
B (100 - 1824°C) B (212 - 3315°F)	N (0.0 - 1399.6°C) N (32.0 - 2551.3°F)	-199.9 - 800.3°C -327.3 - 1472.5°F	0 - 20mA 4 - 20mA
J (-200.1 - 1200.3°C) J (-328.2 - 2192.5°F)	R (0 - 1759°C) R (32 - 3198°F)		0 - 50mV 10 - 50mV (available only on temperature versions)
K (-240.1 - 1372.9°C) K (-400.2 - 2503.2°F)	S (0 - 1759°C) S (32 - 3198°F)		0 - 5V 1 - 5V
L (-0.1 - 761.4°C) L (31.8 - 1402.5°F)	T (-240.0 - 400.5°C) T (-400.0 - 752.9°F)		0 - 10V 2 - 10V

PROCESS INPUT	
Over-range Detection, Under-range Detection and Sensor Break detection	
Under-range Detection	Under-range is detected when the input value is lower than <i>Range Minimum</i> . The input value is valid for reading and control for up to 5% of input span under-range. The accuracy may be reduced when the input is under-range. Sensor break is not detected until the input is at least 10% under-range.
Over-range Detection	Over-range is detected when the input value exceeds <i>Range Maximum</i> . The input value is valid for reading and control for up to 5% of input span over-range. The accuracy may be reduced when the input is over-range. Sensor break is not detected until the input is at least 10% over-range.
Sensor Break Detection	Wire break detected within two seconds. Control outputs set to OFF (0% power); All alarms become active. For DC Linear inputs, this is applicable to 0 - 50mV, 10 - 50mV, 4 - 20mA, 1 - 5V and 2 - 10V ranges only. See also Under-range Detection and Over-range Detection above.
Sensor Short Detection	Thermocouple: Input reads ambient; not detected. RTD: As for under-range operation.

THERMOCOUPLE INPUTS	
Types/Ranges	See above
Measurement Accuracy	Better than ±0.2% of range span ±1 LSD. NOTE: Reduced performance with Type "B" Thermocouple between 100 - 600°C (212 - 1112°F). Type T accuracy is ±0.5% below -100°C,
Linearisation Accuracy	Better than ±0.2°C any point for any 0.1°C resolution range (±0.05°C typical). Better than ±0.5°C any point for any 1°C resolution range.
Cold Junction Compensation	Better than ±1°C over operating temperature range.
Sensor Resistance Influence	<10Ω: as measurement accuracy 100Ω: <0.1% of range span error 1000Ω: <0.5% of range span error

RTD INPUTS	
Type and Connection:	Three-wire (Pt100)
Measurement Accuracy	±0.2% of range span ±1 LSD.
Linearisation Accuracy	Better than ±0.2°C any point (±0.05°C typical).
Temperature Stability	0.01% of range span/°C change in ambient temperature.
Lead Compensation:	Automatic to 50Ω maximum lead resistance, giving less than 0.5% of range span additional error.
RTD Sensor Current:	150µA ±10µA.

DC LINEAR INPUTS	
Measurement Accuracy	Better than ±0.1% of range span ±1 LSD.
Temperature Stability	0.01% of range span/°C change in ambient temperature.
Input Resistance	For mV Input: >1MΩ For V Input: 47kΩ For mA Input: 4.7Ω
Max. Resolution	-32000 to 32000. Equivalent to a 16-bit ADC.

RELAY OUTPUTS	
Contact Type:	<b>RLY1 - RLY4:</b> Single pole single throw (SPST) N/O <b>RLY5 and RLY6:</b> Single pole double throw (SPDT).
Rating:	2A resistive @ 120/240V AC
Lifetime:	>500,000 operations at rated voltage/current.
Isolation:	Inherent.

SSR DRIVE OUTPUTS	
Drive Capability:	12V DC nominal (10V DC minimum) @ 20mA maximum.
Isolation:	Isolated from process input and relay outputs. Not isolated from each other. Not isolated from other similar outputs in the same system.

ALARM CONTROL	
Maximum No. of Alarms:	Two "soft" alarms per input plus four loop alarms.
Maximum No. of Alarm Outputs Available:	Any output can be used for any alarm indication.
Alarm Types Available:	Process High Alarm, Process Low Alarm, Band Alarm, Deviation Alarm, Loop Alarm
Combinatorial Alarms:	Logical OR of alarms to an individual hardware output is available.

LOOP CONTROL	
PID Single Output Loop Control	<b>Automatic Tuning:</b> Easy Tune, Pre-Tune and RaPID. <b>Manual Reset (Bias):</b> Added each control algorithm execution. <b>Auto/Manual Control:</b> User-selectable with "bumpless" transfer into and out of Manual Control.
PID Dual Output Loop Control	<b>Automatic Tuning:</b> Pre-Tune and RaPID. <b>Manual Reset (Bias):</b> Added each control algorithm execution. <b>Auto/Manual Control:</b> User-selectable with "bumpless" transfer into and out of Manual Control.

OPERATING CONDITIONS	
Ambient Temperature:	0°C to 55°C (operating); -20°C to 80°C (storage)
Relative Humidity:	20% - 95% non-condensing (operation and storage).
Supply Voltage:	Powered by BCM within its operating conditions.

APPROVALS	
Product-specific EMC:	EN61326.
Safety:	Complies with EN61010-1 and UL3121-1.

PHYSICAL	
Dimensions:	Height - 100mm; Width - 22mm; Depth - 120mm
Mounting:	35mm Top Hat DIN rail mounting via Interconnect Module.
Connector Type:	5.08mm Combicon type in all cases.
Weight:	0.15kg.