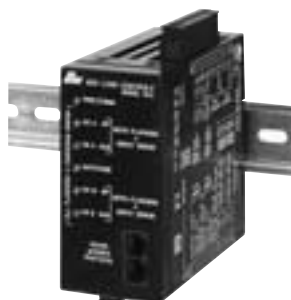


## MODEL DLC - DUAL LOOP CONTROLLER



- MODULAR BUILDING BLOCK FOR MULTI-ZONE PROCESS CONTROL
- TWO INDEPENDENT PID CONTROL LOOPS
- PID CONTROL WITH REDUCED OVERSHOOT
- UNIVERSAL INPUTS ACCEPT TC, RTD, 0-10 V and 0/4-20 mA SIGNALS
- ON DEMAND AUTO-TUNING OF PID SETTINGS
- TWO DC ANALOG OUTPUTS (OPTIONAL)
- WINDOWS® CONFIGURATION SOFTWARE
- RS485 MODBUS™ PROTOCOL
- CHANNEL B CAN BE ASSIGNED AS A SECOND ANALOG INPUT TO CHANNEL A FOR REMOTE SETPOINT OPERATION
- SETPOINT CONTROLLER OPTION FOR TIME VS. TEMPERATURE/PROCESS (RAMP/SOAK) AND SPECIAL BATCH/RECIPE APPLICATIONS



### GENERAL DESCRIPTION

The Model DLC, Dual Loop Controller, is a full featured, DIN rail mounted, dual input PID controller. The DLC is designed as a modular building block for multi-zone process control applications. The controller has two independent "A" & "B" input channels. Each channel's input can be configured to accept a wide range of thermocouple, RTD, 0-10 V, 0/4-20 mA, or resistive signals. Channel B can be also assigned as a Remote Setpoint for Channel A. The two time-proportioning or DC Analog outputs can be programmed to control two independent processes. The two alarms per channel can be configured for various alarm modes, or provide a secondary control output for heat/cool applications.

The control and alarm outputs are N channel open drain MOSFETs capable of switching up to 1 Amp DC. For applications requiring larger loads or A/C loads, several DIN rail mount relays are available.

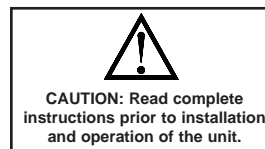
The controller operates in the PID Control Mode for both heating and cooling, with on-demand auto-tune, that establishes the tuning constants. The PID tuning constants may be fine-tuned through the serial interface. The controller employs a unique overshoot suppression feature, which allows the quickest response without excessive overshoot. The controller can be transferred to operate in the Manual Mode, providing the operator with direct control of the output, or the On/Off Control Mode with adjustable hysteresis.

The controller's high density packaging and DIN rail mounting saves time and panel space. The controller snaps easily onto standard top hat (T) profile DIN rails.

### SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Do not use the controller to directly command motors, valves, or other actuators not equipped with safeguards. To do so can be potentially harmful to persons or equipment in the event of a fault to the controller. An independent and redundant temperature limit indicator with alarm outputs is strongly recommended.



### ALARMS

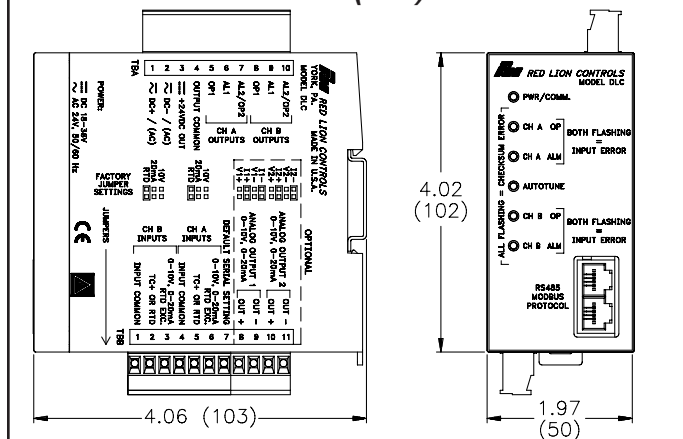
The DLC's two solid-state alarms can be configured independently for absolute high or low acting with balanced or unbalanced hysteresis. They can also be configured for deviation and band alarm. In these modes, the alarm trigger values track the setpoint value. Adjustable alarm trip delays can be used for delaying output response. The alarms can be programmed for Automatic or Latching operation. Latched alarms must be reset with a serial command. A standby feature suppresses the alarm during power-up until the temperature stabilizes outside the alarm region. The outputs can also be manually controlled with Modbus register or coil commands.

### ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBERS
DLC	Dual Loop Controller	DLC00000
	Dual Loop Controller w/ 2 Analog Outputs	DLC01000
	Dual Setpoint Controller w/ 2 Analog Outputs	DLC11000
SF	PC Configuration Software for Windows	SFDLC
CBPRO	Programming Interface Cable	CBPRO007
CBJ	Cable RJ11 to RJ11 (6 inch jumper)	CBJ11BD5
DRR	RJ11 to Terminal Adapter	DRR11T6
P89	Paradigm to RJ11 Cable	P893805Z

See our RSRLYB, RLY6, and RLY7 literature for details on DIN rail mountable relays.

### DIMENSIONS In inches (mm)



## SETPOINT CONTROLLER OPTION

The Setpoint Controller option is suitable for time vs. temperature/process control applications. The controller allows a profile of up to 20 ramp/soak segments. Profile conformity is assured by using the Error Band Mode and Error Band parameter. The Profile Cycle Count allows the profile to run continuously or a fixed number of cycles. Power-on options automatically stop, abort, start, resume, or pause a running profile.

## COMMUNICATIONS

The RS485 serial communications allows the DLC to be multi-dropped, with Baud rates up to 38400. The CBPRO007 programming cable converts the RS232 port of a PC to RS485 and is terminated with an RJ11 connector. The bi-directional capability of the CBPRO007 allows it to be used as a permanent interface cable as well as a programming cable.

## SOFTWARE

The DLC is programmed with Windows® based SFDLC software. The software allows configuration and storage of DLC program files, as well as calibration. Additionally, all setup and control parameters can be interrogated and modified through MODBUS™ register and coil commands.

## ANALOG OUTPUT OPTION

The optional dual DC Analog Output (10 V or 20 mA) can be independently configured and scaled for control or re-transmission purposes. These outputs can be assigned to separate channels, or both outputs can be assigned to the same channel. Programmable output update time reduces valve or actuator activity.

## SPECIFICATIONS

### 1. POWER:

- 18 to 36 VDC, 13 W  
(4 W if +24 VDC Output excitation is unused)
- 24 VAC, ±10% 50/60 Hz, 15 VA  
(7 VA if +24 VDC Output excitation is unused)
- Must use a Class 2 or SELV rated power supply.

### 2. +24 VDC OUTPUT POWER: 24 VDC, +15%, -5%, 200 mA max

### 3. MEMORY: Non-volatile memory retains all programmable parameters.

### 4. INPUT:

- Sample Time:** 100 msec (9.5 Hz)
- Failed Sensor Response:** Open or shorted (RTD only) sensor coils indication, error code returned in Process Value
- Common Mode Rejection:** >110 dB, 50/60 Hz
- Normal Mode Rejection:** >40 dB, 50/60 Hz
- Temperature Coefficient:** 0.013%/°C
- Overvoltage:** 50 VDC max
- Step Response Time:** 300 msec typ., 400 msec max

### 5. THERMOCOUPLE INPUTS:

- Types:** T, E, J, K, R, S, B, N, C, linear mV
- Input Impedance:** 20 MΩ
- Lead Resistance Effect:** 0.25 μV/Ω
- Cold Junction Compensation:** Less than ±1°C typical (±1.5°C max) over 0 to 50°C ambient temperature range or less than ±1.5°C typical (2°C max) over -20 to 65°C maximum ambient temperature range.
- Resolution:** 1° or 0.1° for all types except linear mV (0.1 or 0.01 mV)

TYPE	MEASUREMENT RANGE	WIRE COLOR	
		ANSI	BS 1843
T	-200 to +400°C -328 to +752°F	(+) Blue (-) Red	(+) White (-) Blue
E	-200 to +750°C -328 to +1382°F	(+) Violet (-) Red	(+) Brown (-) Blue
J	-200 to +760°C -328 to +1400°F	(+) White (-) Red	(+) Yellow (-) Blue
K	-200 to +1250°C -328 to +2282°F	(+) Yellow (-) Red	(+) Brown (-) Blue
R	0 to +1768°C +32 to +3214°F	No Standard	(+) White (-) Blue
S	0 to +1768°C +32 to +3214°F	No Standard	(+) White (-) Blue
B	+149 to +1820°C +300 to +3308°F	No Standard	No Standard
N	-200 to +1300°C -328 to +2372°F	(+) Orange (-) Red	(+) Orange (-) Blue
C W5/W6	0 to +2315°C +32 to +4199°F	No Standard	No Standard
mV	-5 mV to 56 mV	N/A	N/A

### 6. RTD INPUTS:

- Type:** 2 or 3 wire
- Excitation:** 150 μA
- Lead Resistance:** 15 Ω max
- Resolution:** 1 or 0.1° for all types

TYPE	INPUT TYPE	RANGE
385	100 Ω platinum, Alpha = .00385	-200 to +600°C -328 to +1100°F
392	100 Ω platinum, Alpha = .003919	-200 to +600°C -328 to +1100°F
672	120 Ω nickel, Alpha = .00672	-80 to +215°C -112 to +419°F
ohms	Linear Resistance	0 to 320 Ω

### 7. TEMPERATURE INDICATION ACCURACY: ± (0.3% of span, +1°C).

Includes NIST conformity, cold junction effect, A/D conversion errors, temperature coefficient and linearization conformity at 23 °C after 20 minute warm up.

### 8. PROCESS INPUT:

INPUT RANGE	ACCURACY * (18 to 28°C) (10 to 75% RH)	IMPEDANCE	MAX CONTINUOUS OVERLOAD	RESOLUTION
10 VDC (-1 to 11)	0.10% of reading +0.02 V	1 MΩ	50 V	1 mV
20 mA DC (-2 to 22)	0.10% of reading +0.03 mA	10 Ω	100 mA	1 μA

\* Accuracies are expressed as ± percentages after 20 minute warm-up.

### 9. ISOLATION LEVEL: 500 V @ 50/60 Hz, for one minute (50 V working) between the following groups:

- Ch A Input and all Control & Alarm Outputs <sup>1</sup>
- Ch B Input
- RS485/Analog Output <sup>2</sup>
- Power Supply

Notes:

- <sup>1</sup> Ch A Input and All Control/Alarm Outputs share the same common
- <sup>2</sup> RS485 and Analog Outputs are not internally isolated. Their commons must not be connected together externally for proper unit function (i.e., earth ground).

### 10. SERIAL COMMUNICATIONS:

- Type:** RS485; RTU and ASCII MODBUS modes
- Baud:** 300, 600, 1200, 2400, 4800, 9600, 19200, and 38400
- Format:** 7/8 bits, odd, even, and no parity
- Transmit Delay:** Programmable: See Transmit Delay explanation.
- Transmit Enable (TXEN):** (primarily for 20 mA loop converter) open collector V<sub>OH</sub> = 10 VDC max, V<sub>OL</sub> = 0.5 VDC @ 5 mA max current limit

### 11. A/D CONVERTER: 16 bit resolution

### 12. CONTROL AND ALARM OUTPUTS:

- Type:** Non-isolated switched DC, N Channel open drain MOSFET
- Current Rating:** 1 A max
- V<sub>DS ON</sub>:** 0.3 V @ 1 A
- V<sub>DS MAX</sub>:** 30 VDC
- Offstate Leakage Current:** 0.5 mA max

### 13. MAIN CONTROL:

- Control:** PID or On/Off
- Output:** Time proportioning or DC Analog
- Cycle Time:** Programmable
- Auto-Tune:** When selected, sets proportional band, integral time, derivative time values, and output dampening time
- Probe Break Action:** Programmable

### 14. ALARM: 1 or 2 alarms

**Modes:**

- Manual (through register/coil)
- Absolute High Acting (Balanced or Unbalanced Hysteresis)
- Absolute Low Acting (Balanced or Unbalanced Hysteresis)
- Deviation High Acting
- Deviation Low Acting
- Inside Band Acting
- Outside Band Acting

**Reset Action:** Programmable; automatic or latched

**Standby Mode:** Programmable; enable or disable

**Hysteresis:** Programmable

**Sensor Fail Response:** Upscale

15. **COOLING:** Software selectable (overrides Alarm 2).

**Control:** PID or On/Off

**Output:** Time proportioning or DC Analog

**Cycle Time:** Programmable

**Proportional Gain Adjust:** Programmable

**Heat/Cool Deadband Overlap:** Programmable

16. **ANALOG DC OUTPUTS:** (optional)

Control or retransmission, programmable update rate from 0.1 sec or 1 to 250 sec

**Step Response Time:** 100 msec

OUTPUT RANGE**	ACCURACY * (18 to 28°C) (10 to 75% RH)	COMPLIANCE	RESOLUTION (TYPICAL)
0 to 10 V	0.10% of FS + 1/2 LSD	10 KΩ min	1/18000
0 to 20 mA	0.10% of FS + 1/2 LSD	500 Ω max	1/18000
4 to 20 mA	0.10% of FS + 1/2 LSD	500 Ω max	1/14400

\* Accuracies are expressed as ± percentages after 20 minute warm-up.

\*\* Outputs are independently jumper selectable for either 10 V or 20 mA.  
The output range may be field calibrated to yield approximate 10% overrange and a small underrange (negative) signal.

17. **ENVIRONMENTAL CONDITIONS:**

**Operating Temperature Range:** -20 to +65°C

**Storage Temperature Range:** -40 to +85°C

**Operating and Storage Humidity:** 85% max relative humidity, noncondensing, from -20 to +65°C

**Altitude:** Up to 2000 meters

18. **CERTIFICATIONS AND COMPLIANCE:**

#### SAFETY

EN 61010-1, IEC 1010-1

Safety requirements for electrical equipment for measurement, control, and laboratory use, Part I

#### ELECTROMAGNETIC COMPATIBILITY

##### Immunity to EN 50082-2

Electrostatic discharge	EN 61000-4-2	Level 3; 8 kV air <sup>1</sup>
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m 80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 kV I/O Level 3; 2 kV power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms 150 KHz - 80 MHz

##### Emissions to EN 50081-2

RF interference	EN 55011	Enclosure class A Power mains class A
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<sup>1</sup> This controller was designed for installation in an enclosure. To avoid electrostatic discharge to the unit in environments with static levels above 6 kV, precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure (ex. making adjustments, setting switches etc.), typical anti-static precautions should be observed before touching the controller.

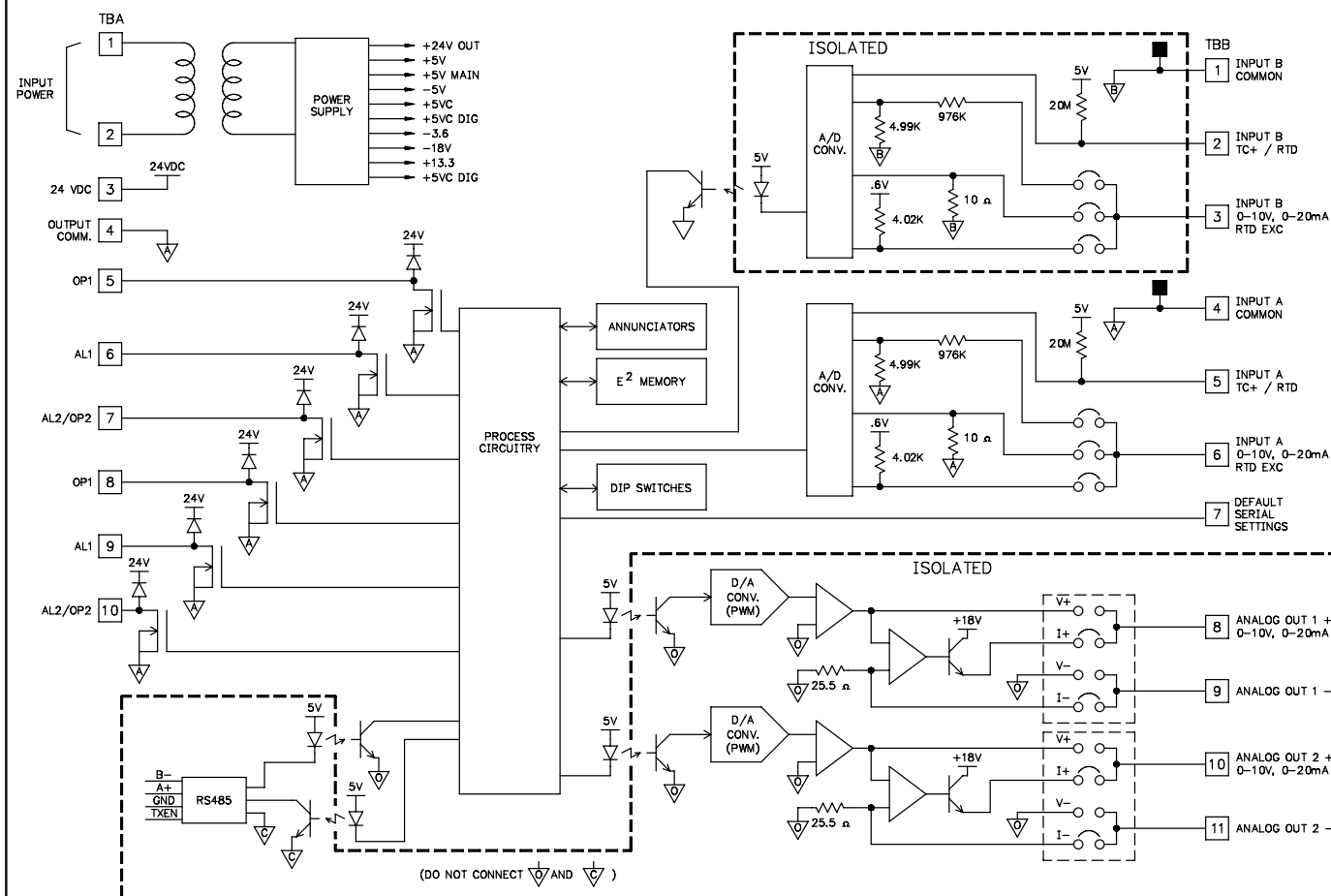
19. **CONSTRUCTION:** Case body is black high impact plastic. Installation Category I, Pollution Degree 2.

20. **CONNECTIONS:** Wire clamp screw terminals. Removable terminal blocks.

21. **MOUNTING:** Snaps on to standard DIN style top hat (T) profile mounting rails according to EN50022 -35 x 7.5 and -35 x 15.

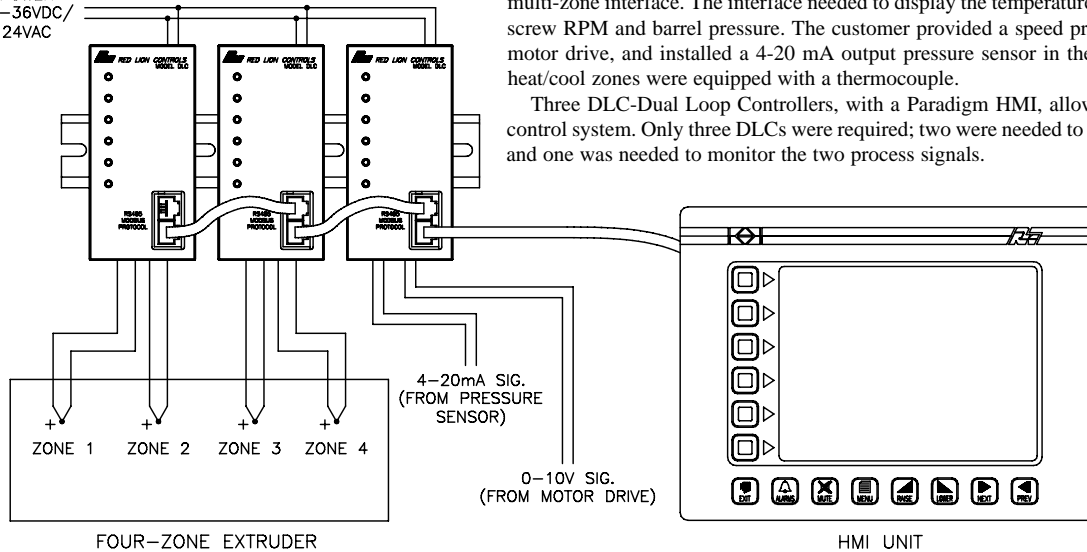
22. **WEIGHT:** 10.5 oz. (298 g.)

### BLOCK DIAGRAM



## APPLICATION

POWER  
18-36VDC/  
24VAC



A plastic extrusion company was building a four-zone extruder, and wanted a centrally located, multi-zone interface. The interface needed to display the temperature and setpoint values, as well as the screw RPM and barrel pressure. The customer provided a speed proportional 0-10 Volt signal from a motor drive, and installed a 4-20 mA output pressure sensor in the extruder barrel. Each of the four heat/cool zones were equipped with a thermocouple.

Three DLC-Dual Loop Controllers, with a Paradigm HMI, allowed the customer to build his own control system. Only three DLCs were required; two were needed to control the four temperature zones, and one was needed to monitor the two process signals.

All three units were connected to the RS485 port of the Paradigm display. The customer created his own displays on the HMI, which allowed him to monitor and control the setpoints and alarms within the DLCs. The Paradigm's multi-protocol capability allowed it to tie the DLCs to his PLC, creating a true centralized interface.

*Representante exclusivo:*

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