

**UNIPRO v3.5  
Users Manual**



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MARATHON MONITORS INC**

## Description and Applications

The Marathon Monitors Inc. UNIPRO Controller/Programmer represents the latest technology in microprocessor-based process control instrumentation. Through flexible PID (Proportional, Integral, Digital) control along with programmable features, even the most complex, system can be handled. For a thorough explanation of PID please refer to Zeigler and Nichols; "Optimum Settings for Automatic Controllers", Transactions of ASME, Nov. 1942. Or St. Clair, David W.; Controller Tuning and Control Loop Performance, a Primer; Straight-Line Control Company, Newark ,Delaware 1989.

The UNIPRO's control actions are based upon input from a Thermocouple, RTD, Voltage or Current source. The UNIPRO allows Manual, Automatic, or Programmed control of a single loop. Its built-in RS-422 computer interface allows it to be completely supervised by a computer, either on-site or in some remote location within the plant. The Programmer can be used, and is strongly recommended, to allow complete control of temperature or other process cycles.

The following features have been included to allow use of the instrument in a wide variety of applications:

Fully site-configurable for single point control from one of three (3) fully isolated analog input sources, each separately configurable for thermocouple, RTD, voltage, or current.

Powerful process/logic programmer that can store up to two-hundred (200) programs, each consisting of nineteen (19) steps, subroutine calls, test and branch capability, and full access to all instrument parameters.

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Two (2) control output triacs for use in single or dual control mode.

Two (2) fully isolated analog outputs, each separately configurable for voltage or current output.

Two (2) configurable alarm triacs, assignable as process Alarms, deviation alarms, program alarms, or fault alarms.

Four (4) programmer events, assignable in any combination as either inputs or outputs (expandable to 16 I/O with external event boards).

Three (3) communication ports for talking with host computers, controllers, and discrete digital and / or analog event expansion racks.

This manual provides all of the information required to install, operate and maintain the MMI UNIPRO.

The manual is divided into parts: Installation, Setup and Configuration, Operation, Programming, and Maintenance and Troubleshooting. Installation and Setup and Configuration will be used initially to get the instrument into use. Operation and Programming will be used daily. Maintenance and Troubleshooting will be used for servicing the instrument periodically or if trouble occurs.

## Installation

### Installation Location

The UNIPRO instrument is designed for 1/8 inch panel mounting in a DIN standard opening of 5.43 inches square (adapter panels available by special order). Required rear clearance is 10.5 inches to allow for wiring. As with all solid state equipment, the controller should be away from excessive heat, humidity, and vibration (refer to specifications). Since the unit uses red LED display devices, avoid placing it in direct sunlight to reduce interference with the display's visibility. The instrument requires 100/120/200/240 VAC (jumper selectable on power interconnect board inside the rear panel) 50/60 Hz. It should not be on the same circuit with other noise-producing equipment such as induction machines, large electrical motors, etc. All instrument wiring must be run separate from all control wiring.

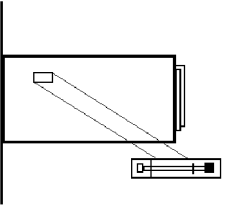
### Panel Mounting/Removal

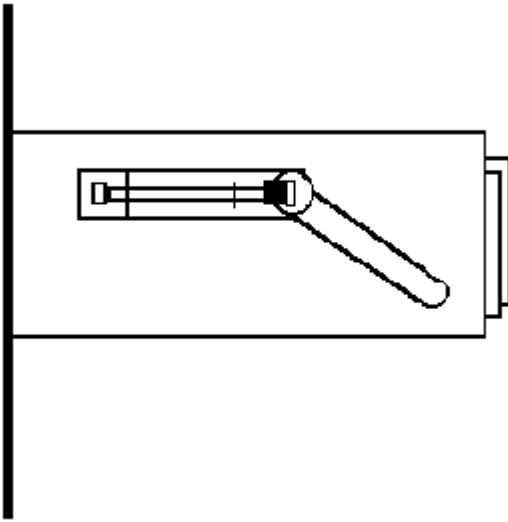
Because the instrument uses a ventilated enclosure, it is not dust-tight and should therefore always be mounted in a sealed control panel. To mount the UNIPRO in a control panel, a hole must be cut 5.43 inches square in the necessary location on the panel. The following procedure should be followed to mount the UNIPRO in the panel.

1. Insert the unit into previously cut out 5.43 inches square hole in the panel.
2. While supporting the unit, insert one slotted clamping bracket, with head of the bolt facing to the rear of the unit, into the 0.62 inch by 0.82 inch cutout on the side of the unit.

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3. Repeat step 2 for the opposite side of the unit.
4. With 1/8 inch HEX KEY wrench, alternately tighten bolts on either side of the instrument to a torque of 4 in-lbs. (See warning below). Insure rigidity of mounting.

### **Warning**

**To prevent warping of the unit's case, do not over tighten the clamp bolts.**

5. To remove the unit, loosen the side clamping brackets and reverse steps 1 through 3 above.

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On subsequent removals and installations the rear panel can be removed (4 screws) and the wiring does not have to be disturbed.

## Warning

**All connections, rear panel installations and removals; plus triac board installations and removals must be done with power removed from TBA and TBB. All PC boards should only be removed or installed with power off via the switch mounted on the triac board. Otherwise, serious personal and/or equipment damage can occur.**

## Thermocouples and Other Signal Wires

The wiring used to connect the signal wires to the instrument should be run in a conduit, separate from any AC lines in the area. This provides noise immunity and physical protection.

Thermocouples should be wired with the appropriate alloy extension wire with no termination other than at the instrument. As with all cold-junction compensating instruments, extreme care should be used when an existing thermocouple is to be used for both the Controller and another instrument at the same time.

## Control Devices

The UNIPRO provides simple ON/OFF as well as Proportional control through its two contact closure Control Outputs (TBA-7, TBB-7, TBA-8, and TBB-8) and two Analog Outputs (TBD-13 through TBD-16). Refer to the Section on Control Modes for more details on the outputs. This allows control through simple ON/OFF devices or through Proportional control methods.

**SIMPLE ON/OFF CONTROL:** Set Control Mode for ON/OFF Control. This provides contact closure at Control Output #1 to control absolute heat application/removal for such devices as heating elements, etc.

Three types of Proportional control are:

1. **Time-Proportioning:** Referring to the modulation of the duty cycle. That is, changing the ratio of On Time versus Off Time in systems that use such devices as heating elements, electronically operated/assisted valves, or servo drives that use analog command signals for control.
2. **Position-Proportioning:** Referring to the adjustment of a variable positioning device such as a positioning motor with slidewire feedback.
3. **Voltage or Current Output Proportioning:** An Analog output's (voltage or current) amplitude is varied based on input from rheostats, thermocouples, ammeters, etc. to control heat applications.

The UNIPRO provides many ways to use the above control methods. Setup has details for setting the Control Modes to determine the method to be used. Some typical applications for the Proportioning method are:

1. **HIGH/LOW or HEAT COOL heat application system:** Set Control Modes for Time-Proportioning. This provides that CONTROL OUTPUT #1 (TBA-7, TBB-7) and CONTROL OUTPUT #2 (TBA-8, TBB-8) are in opposite conditions at either extreme of the control range and are both OFF at the midpoint of the control range.
2. **ANALOG OUTPUT control:** Set Control Modes for Time-Proportioning. This provides a 0 to 5 VDC or 4 to 20 mA output which is selectable on the ANALOG OUTPUT BOARD (TBD-13 through TBD-16, see Section 2.14 and Section 8.0 for



more details). The output control is based on 0 to 99% of the output device's control range. For example, 50% control would equal 2.5 VDC out where 5 VDC equals maximum heat output of the drive. This can be used with servo drives that require a voltage or current command signal for controlling heat output or servo positioning.

3. POSITIONING MOTOR with SLIDEWIRE FEEDBACK: Set Control Modes for Single Position-Proportioning with slidewire feedback. CONTROL OUTPUT #1 will drive the motor in the open direction, CONTROL OUTPUT #2 in the close direction.

Remember, the above methods are just examples of the typical applications of the UNIPRO. Please call your MMI representative or application engineer for questions concerning your particular system.

## Chart Recorders

If a chart recorder is to be used, it must have input specifications within the following ranges:

0 to 4 VDC

0 to 45 mA

corresponding to a FRONT PANEL display of 0-2000. The ideal location of the recorder is adjacent to the instrument but it may be located remotely if the connecting wires are properly shielded.

Long wiring runs from the chart recorder outputs may require resistive termination

(2 K ohms or so) at the chart recorder input(s) should be isolated from ground.

## Computer Interface

If you wish to take advantage of the UNIPRO's RS-422 digital communications capabilities, refer to "Communications" for more details.

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## Alarms

Two user-programmable triac alarm contacts are available for connection in appropriately-engineered systems.

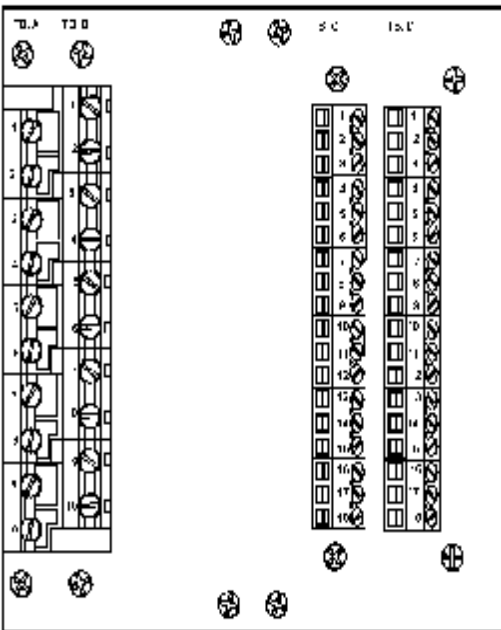
## Programmer

The Programmer can run an entire process, depending on how thoroughly the capabilities are set up and used. Refer to "Operation" and "Programming" for further information.

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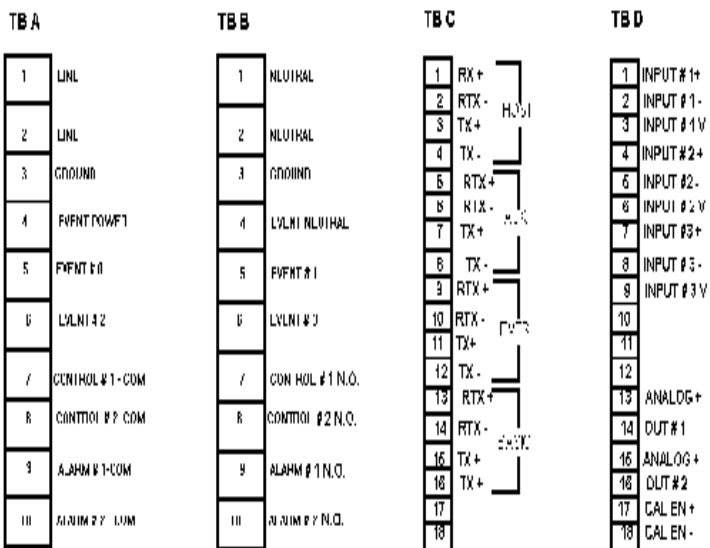
## Electrical Connections

Connections to the unit are made via four terminal blocks, on the rear panel, labeled TBA, TBB, TBC, and TBD. (Position 1 is at the top the position 10 (TBA and TBB) or 18 (TBC and TBD) is at the bottom of the terminal strip.) AC power, event, control, and alarm connections are made on TBA and TBB. All communications are on TBC and all analog I/O signals are on TBD. Refer to the Figure below for a complete layout of the UNIPRO rear panel connections.





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## UNIPRO Rear Panel

### UNIPRO Electrical connections

#### AC Power

The UNIPRO requires 100/120/200/240 VAC at 1 AMP,

#### Communications

Three communications busses are at TBC and use RS-422 full or half duplex protocol for all ports. (Refer to "Communications" in Maintenance and Troubleshooting.) Typically, the HOST port will connect to a host computer, the AUXILIARY BUSS to other instruments, and the OPTOMUX PORT to OPTOMUX I/O devices.

## Analog Inputs

The UNIPRO allows for three analog inputs with their individual functions determined by "daughter board" located on the analog input board inside the unit. The standard connection, at TBD, will have the first input as a thermocouple, the second for the oxygen probe, and the third optionally used to input voltage or milliamp signals.

## Analog Outputs

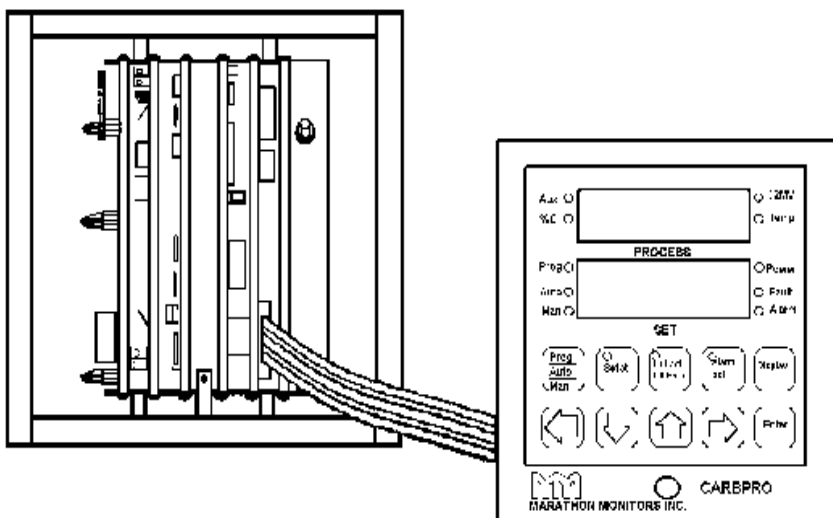
Two, separate, isolated analog outputs are provided on TBD and can be selected as 4-20 mV (for maximum accuracy, see Specifications for further details) or 0-10 V output through DIP switch settings on the analog output board. Additionally, outputs can be calibrated by placing a jumper on the two terminals supplied.

## DIP Switch Setup

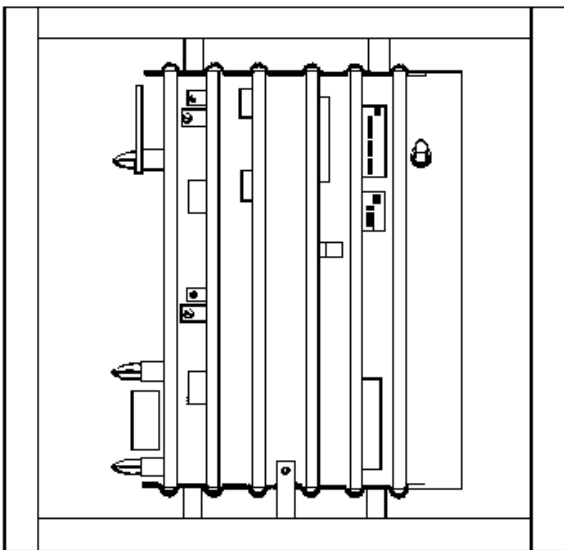
The user may use the UNIPRO in a multi-instrument system by giving the instrument a unique HOST address, specified by using the DIP switches on the Interface Board inside the UNIPRO. To get to the DIP switches, loosen the black knurled knob on the front panel by turning in a counterclockwise direction. Carefully remove the front panel but DO NOT remove the ribbon cable connecting the front panel to the Interface Board. Safely support the front panel near the instrument. Adjust the DIP switches per Section 2.16 for the desired operating mode. When switch adjustment is complete, replace the front panel to prevent contamination.

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## UNIPRO Front Panel Removal



Find the appropriate switches by referring to the figure below.



## UNIPRO Internal Layout DIP Switch Assignments

### Bank 0

Switch #	Description
1	Unassigned
2	Unassigned
3	Slide wire Deadband (see the following table)
4	Slide wire Deadband (see the following table)
5	Slide wire Deadband (see the following table)
6	Unassigned
7	Unassigned
8	Service (Must be OFF)

Selectable deadband for slidewire feedback control.



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Slidewire Dead Band Offset			
offset	Switch 3	Switch 4	Switch 5
0.4%	OFF	OFF	OFF
0.8%	ON	OFF	OFF
1.2%	OFF	ON	OFF
1.6%	ON	ON	OFF
2.0%	OFF	OFF	ON
2.4%	ON	OFF	ON
2.8%	OFF	ON	ON
3.2%	ON	ON	ON

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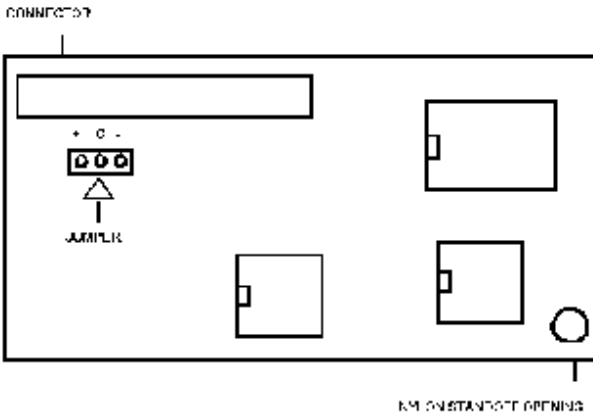
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Each UNIPRO in a multiple instrument system must have a unique address for proper communications.

HOST address selection switches: Bank 1Address

DEC	HEX	SW1	SW2	SW3	SW4
0	0	OFF	OFF	OFF	OFF
1	1	ON	OFF	OFF	OFF
2	2	OFF	ON	OFF	OFF
3	3	ON	ON	OFF	OFF
4	4	OFF	OFF	ON	OFF
5	5	ON	OFF	ON	OFF
6	6	OFF	ON	ON	OFF
7	7	ON	ON	ON	OFF
8	8	OFF	OFF	OFF	ON
9	9	ON	OFF	OFF	ON
10	A	OFF	ON	OFF	ON
11	B	ON	ON	OFF	ON
12	C	OFF	OFF	ON	ON
13	D	ON	OFF	ON	ON
14	E	OFF	ON	ON	ON
15	F	ON	ON	ON	ON

## Thermocouple Burnout Jumper Selection

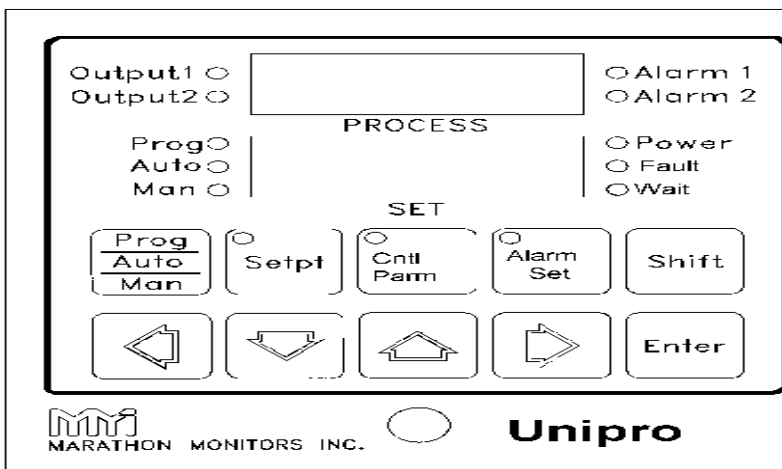


The thermocouple jumper selects either a full upscale or a full down scale reaction to take place when a thermocouple fails or becomes open. The jumper can be found on the thermocouple board, and has two possible settings (see Figure). For full scale upwards, place the jumper from the + to the C, and for full scale downwards, place the jumper from the - to the C.

## Setup And Configuration

### Front Panel

The front panel of the UNIPRO consists of three main parts, two display windows and a keyboard. Refer to the figure shown below for a layout of the front panel. The display windows each contain four 14-segment digits that are used to display helpful messages and numerical parameter values.



### PROCESS Display

This 4 digit 14-segment display provides the value of the current process value, along with messages for ease of operator use when setting up parameters. The PROCESS window displays the step number and OPCODE when in the Program Editor.

### SET Display

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This 4 digit 14-segment display provides the value of the process setpoint value during Auto and Program operation. In Manual mode the Time-Proportioning % Output value is displayed. During operator input procedures this display shows the data being entered. The SET window displays the corresponding data for the OPCODES displayed in the PROCESS window when in the Program Editor.

## LEDs

Several small LEDs indicate operations and functions of the UNIPRO. Ten are on the face and three are in the keys.

Output 1        indicates when the Output 1 Control relay is closed.

Output 2        indicates when the Output 2 Control relay is closed.

Alarm 1         indicates when the process value has closed the relay based upon trip point and type of alarm.

Alarm 2         indicates when the process value has closed the relay based upon the trip point and type of alarm. Also, if Switch 6, Bank 1 is ON the LED indicates the closed control output relay.

Prog            indicates that a program is running and Automatic control is activated. If flashing, the program is in HOLD. Refer to the section "The Programmer".

Auto            indicates that the UNIPRO is in Automatic control mode. If flashing, a program is in HOLD.

Manual         indicates that no control action is being executed by the UNIPRO. If flashing, a program is in HOLD.

Power          indicates that the UNIPRO's 5 volt power supply is functioning.

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Fault indicates that an open circuit is detected at the signal input.

Wait indicates that the Programmer is waiting for some condition to be satisfied before continuing.

Setpt indicates that the Setpt Enter mode has been selected.

Cntrl Parm indicates that the Control Parameter Enter mode has been selected.

Alarm Set indicates that the Alarm Setup mode has been selected or one or both alarm values are non-zero.

## Keyboard

The UNIPRO keyboard consists of ten keys for operating and programming the instrument. There are no "hidden" keys on the UNIPRO keyboard.

Various operations with the UNIPRO involve dual-key operations using the [Shift] key in the same way a shift key on a typewriter is used. When activating a dual-key assignment do not try to press both keys simultaneously; rather, follow the sequence below:

1. Press and hold the [ Shift] key,
2. Press and release the second key,
3. Release the [Shift] key.

### KEY

### DESCRIPTION



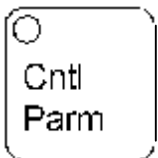
This key selects the operating mode of the UNIPRO. The mode selected is indicated by the illuminated LED.



This key selects the Setpoint Enter mode where the Setpoint, Setpoint Offset and Reference Number can be accessed and altered. When used in the dual-key operation Shift/Setpt it allows the operator to pull any program into the edit space or decrease the remaining time of a program step if a program is currently running.

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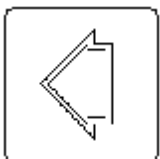
This key selects the Control Parameter Enter mode where the Proportional Band, Reset, Rate, Cycle Time and Percent Output values (if in solenoid mode) can be accessed and altered. When used in the dual-key operation Shift/Cntrl Parm it selects the keyboard Lock Level change mode.



This key selects the Alarm Setup mode where the Alarm 1 and Alarm 2 conditions can be accessed and altered or Alarm 2 can be used to determine setpoint for auxiliary control loop. When used in the dual-key operation Shift/Alarm Set it selects the Thermocouple Type, Custom Features, and Events Partition. After Shift/Alarm Set the Thermocouple Type is initially displayed, if Enter is pressed the Custom Feature option is available while the second press of Enter allows the Events Partition to be observed and altered if necessary.



This key has no function by itself. The function of the Shift key is for all dual-key operations, Security Sequence and the start-up sequences.

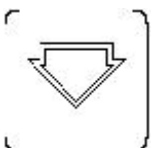




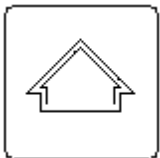
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usually used to select which digit is to be modified in a data entry mode. In Manual mode this key will cause the control output to go to the full reverse control direction while the value is displayed in the SET window. In Automatic mode pressing "left arrow" causes the % on-time valve position to be displayed in the SET window. (positive-Output 1, negative-Output 2). In the Programmer Status Display it causes the display to move to a new page.\*\*

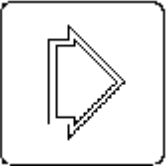


usually used to decrease the value of a digit in the data entry mode or scroll through various parameter sequences. In Manual mode this key will cause the control action to move toward the Output 2 direction. When used in the dual-key operation Shift/"down arrow" it accesses the Programmer Status Display.

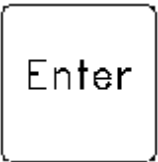


usually used to increase the value of a digit in the data entry mode or scroll through various parameter sequences. In Manual mode this key will cause the control action to move in the Output 1 direction. When used in the dual-key operation

Shift/"up arrow" an LED test is activated, where every segment and decimal point should light in both displays. If any segment or decimal point does not light a keyboard problem may exist, contact a qualified MMI representative.



usually used to select which digit is to be modified in a data entry mode. In Manual mode this key will cause the control output to go to the full Output 1 direction. In the Programmer Status Display mode it causes the display to move to a new page.



this key is used to enter data, clear alarms, or cancel programs.

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MENU CON	MENU INP	MENU AOUT	MENU COM	M Pl
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res xxxx	cjca xxxx	ao1o xxxx	auxm xxxx	:
rate xxxx	iaof xxxx	ao1r xxxx	aux xxxx	a :
cyc xxxx	iasp xxxx	ao2 xxxx	ssoa xxx	l p
hipo xxxx	iadp xxx	ao2o xxxx	sso1 xxxx	l
lopo xxxx	in b *	ao2r xxxx	:	:
ldln xxxx	in C *		sso8 xxxx	
conv xxxx	Tc °X			
Cm x xx				
setp xxxx				

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## Control Parameter Key Menu Selections

The following shows the order of configuration options set from the [Cntl Parm] key and their range of values.

Press [ENTER] to go forward to the next option, or [Shift] to back up to a previous option. The arrow keys are used to change the option within its limits see the keys portion of this section for a complete description of how they are used. Pressing [Cntl Parm] at any time will exit from this option setup sequence.

Note  
Options are saved as they are changed.

CON menu

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Propor

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band

0 to 99.99

Reset

0 to  
9.99

Rate

1 to  
250

Cycle  
time in  
second  
s

0 to  
100

High  
limit

on  
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output

-100 to  
100

Low  
limit  
on  
percent  
output

-100 to 100

Load  
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CON menu Continued...

Process  
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Set  
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or  
reverse

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source;  
local or  
input C



### INP menu

Input A, B, or C values and actions are programmed from this menu. Display choices shown are for input A. The other input choices follow through the same cycle. Exceptions are noted in the table. Thermocouple degree choices for temperature display come at the end of the full menu cycle.

### Process

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f  
o  
r  
  
l  
i  
n  
e  
a  
r

T  
c  
  
?  
  
F  
o  
r  
  
t  
h  
e

r  
m  
o  
c  
o  
u  
p  
l  
e  
  
t  
y  
p  
e  
  
\*

O  
f  
f

P



r  
o  
g  
  
f  
o  
r  
  
P  
r  
o  
g  
r  
a  
m  
m  
e  
d  
.  
  
I  
n  
p  
u  
t  
  
C  
  
h  
a  
s  
  
t  
h  
r  
e  
e

m  
o  
r  
e  
  
c  
h  
o  
i  
c  
e  
s  
  
L  
  
3  
0  
,  
  
L  
5  
0  
,  
  
a  
n  
d  
  
L  
1  
0  
0  
.



Y  
E  
S, NO

Cold  
junctio  
n  
compe  
nsation  
active  
for  
input A

-999  
to  
9999

Input  
A  
offset  
for  
progra  
m  
mode

-999 to 999

Input  
A span  
value  
for  
progra

m  
mode

0 to 3

Input  
A  
display  
ed  
decima  
l point  
locatio  
n for  
progra  
m  
mode.

de  
g  
F,  
deg C

Tempe  
rature  
display  
units

Notes:

\* thermocouple types are found in the specifications. Values and types are also found in Maintenance and Troubleshooting.

**AOUT** menu  
P

P  
O  
,  
I  
N  
B  
,  
P  
2  
0  
,  
P  
2

1

,

A  
n  
a  
l  
o  
g

o  
u  
t  
p  
u  
t

1

s  
o  
u  
r  
c  
e

\*

REFN, PROG, TEMP,  
AUX

9

9  
9  
t  
o  
9  
9  
9  
9  
A  
n  
a  
l  
o  
g  
o  
u  
t  
p  
u  
t  
l  
o  
f  
f  
s  
e  
t



0

t  
o  
9  
9  
9  
9

A  
n  
a  
l  
o  
g  
o  
u  
t  
p  
u  
t

l  
r  
a  
n  
g  
e

Analog out put 2  
choices are the same  
menu items repeated.

\*Analog output  
source 1 menu items:

PO = percent  
output

IN B = input B

P 20 & P 21 are specialized parameter  
settings. Check with your programmer  
before entering data.

REFN = the reference number

PROG = the program

TEMP = temperature

AUX =Auxiliary output

## COM menu

### P

r  
o  
c  
e  
s  
s

d  
i  
s  
p  
l  
a  
y

---

S  
e  
t

d  
i  
s  
p  
l  
a  
y

---

D  
e  
s  
c  
r  
i  
p

t  
i  
o  
n

H or  
F, E  
or N

Host  
commu  
nicatio  
ns  
setup  
and 0 to 3

TE  
M  
or  
UDC

Aux  
commu  
nicatio  
ns port  
mode;  
MMI  
10Pro  
or  
Honey  
well  
UDC3  
000

H or  
F, E or  
N

Aux  
commu  
nicatio  
ns  
setup  
and  
0

t  
o

3

NO,  
YES

Slave  
setpoin  
t offset  
active

-500  
to 500

Slave  
temper  
ature

control  
ler  
setpoint  
offset  
The  
UNIPRO  
O can  
transfer  
r 7  
slave  
temper  
atures  
and  
have  
an  
offset  
for  
each.  
Address  
s 1 is  
the  
original  
UNIPRO  
O.

Notes:  
communications choices for the

UNIPRO are:

H = Half

or

F = full duplex

E = even

or

N = no parity

BAUD rate code

0 = 1200

1 = 4800

2 = 9600

3 = 19.2k

## PROG menu

### P

r  
o  
c  
e  
s  
s

d  
i  
s  
p  
l  
a  
y

---

S  
e  
t

d  
i  
s  
p  
l  
a  
y

---

D  
e  
s  
c  
r  
i



p  
t  
i  
o  
n

NO,  
YES

Auto  
start-  
up

NO,  
YES

Auto  
progra  
m start

NO, YES

Asynch  
ronous  
event

0 to  
3

Lock  
level

The  
most  
accessi  
ble  
level is  
3, the  
least is  
0. To  
set a  
passwo  
rd see  
below.

### Password Entry

The password can be entered by pressing the Dual-key sequence [Shift] + [Cntl. Parm] keys. Any order of keys, except for the [Shift] or [ENTER] key, can be entered as a password, up to nine keys maximum. Press [ENTER] to save the password. The number in the set display will count the number of keys entered. Pressing [ENTER] without pressing any other key (i.e. set display=0) will clear the password. So to have no password the sequence [Shift] +

[Cntl Parm], [Enter], [Enter]  
,[Enter] must be pressed.

## EVTS menu

P

r  
o  
c  
e  
s  
s

d  
i  
s  
p  
l  
a  
y

---

S  
e  
t

d  
i  
s  
p  
l  
a  
y

o  
p  
t  
i  
o  
n  
s

---

---

D  
e  
s  
c  
r  
i  
p  
t  
i  
o  
n

NO,  
YES

Extern  
al  
event  
boards  
active

1200  
, 4800

Events  
commu  
nicatio  
ns  
baud  
rate

0 to 4

Events  
partition  
internal

0 to  
16

External  
analog  
board  
partition?

Where  
? is  
0,1, 2,  
3, 4, 5,  
6, 7, 8,  
9, A,  
B, C,  
D, E, F  
Representing  
module  
s 0

through  
h 15  
respect  
ively.

XXX

Extern  
al  
analog  
board  
module  
lineariz  
ation.  
Where  
XXX =  
lin,  
prog,  
n/a or  
thermo  
couple  
type  
and  
value \*

All thermocouple displays have TC X format where X = thermocouple type. See the list below

Thermocouple list:

<u>Display</u>	<u>T/c Type</u>
	B
C	C
E	E
J	J
K	K
N	N
NM	NM
R	R
S	S
T	T



## [Alarm Set] key

The [Alarm Set] key also sets some parameters. Its menu is limited to alarm functions. Again [Enter] and [Shift] move forward or back through the selections while setting up, [arrow] keys change values and [Alarm Set] exits. All values are saved as they are changed.

### Alarm Set key

P

r  
o  
c  
e  
s  
s

d  
i  
s  
p  
l  
a  
y

---

S  
e  
t

d  
i  
s  
p  
l

a  
y

o  
p  
t  
i  
o  
n  
s

---

---

D  
e  
s  
c  
r  
i  
p  
t  
i  
o  
n

See  
not  
es

Alarm  
1  
mode.  
Selects  
which  
variabl  
e, type

of  
alarm,  
and  
whethe  
r direct  
or  
reverse  
acting.  
See  
notes  
below.

-999 to  
9999

Alarm  
1  
value.  
Decim  
al point  
is  
automa  
tically  
set  
based  
on  
control  
variabl  
e and  
type of  
alarm.

0 to  
250

Alarm  
1 turn  
on  
delay  
time in  
second  
s.

0 to  
250

Alarm  
1 turn  
off  
delay  
time in  
second  
s.

At this point, if there is no need for ALARM 2 to be set, press [Alarm Set] to exit alarm parameters.

If ALARM 2 does need to be set, press [Enter]. Use the information starting at the top of the table for ALARM 1. The process display will change only from a 1 to a 2. All other information in the table remains accurate for ALARM 2.

Notes:

Variable	Description
----------	-------------

D This is  
DIRECT  
operation for  
alarm actuation  
(i.e. the contact is  
normally open  
until it reaches the  
trigger limit  
specified in the  
ALARM VALUE  
then the contact  
closes).

Notes: continued

Variable	Description
R	REVERSE operation (opposite of NORMAL) for ALARM actuation (i.e. the alarm contact is normally closed until it reaches the trigger limit specified in the ALARM VALUE then the contact opens).

IN B Alarm actuation is based on the analog signal at Input B inputs exceeding the limit in the Alarm Value. Input B inputs is physically located at TBD-4, TBD-5, and TBD-6 on the unit's rear connectors.

AUX Alarm actuation is based on the analog signal at Input C exceeding the limit in the ALARM VALUE. Input C is physically located at TBD-7, TBD-8, and TBD-9 on the unit's rear conductors.

BND Alarm actuation uses BAND WIDTH control above and below a programmed setpoint limit. (i.e. If the band is set by the ALARM VALUE to 0.10 and the

programmed setpoint is at 0.80, the alarm will trigger at 0.90 and 0.70.)

**DEV** Alarm actuation uses DEVIATION control above or below the programmed setpoint. The + and - symbols determine if the deviation is allowed or if it is above (+) the programmed setpoint or below (-) it. (i.e. If deviation of 0.10 is placed in the ALARM VALUE and 0.80 is the programmed SETPOINT the alarm will trigger at 0.90 or 0.70, for -0.10.)

**FLT** An input FAULT, or a program alarm is to be used as basis for the actuation. The ALARM VALUE is ignored.

**PRG** An Internal program will actuate the alarm.

**PO** Alarm actuation is based on the PERCENT OUTPUT exceeding the limit in the ALARM VALUE .

**PV** PROCESS control mode. Alarm actuation is based on the PROCESS VARIABLE exceeding the limit in the ALARM VALUE.

## [SETPT] key

Parameter entry under the [Setpt] key is the same procedure as under the other two keys controlling parameters. [Enter] moves forward [Shift] moves back and [arrow] keys change the values in a parameter. [Setpt] exits and values are saved when changed.

Setpt key

P

r  
o  
c  
e  
s  
s

d  
i  
s  
p  
l  
a  
y

---

S  
e  
t

d  
i  
s  
p  
l

a  
y

o  
p  
t  
i  
o  
n  
s

---

---

D  
e  
s  
c  
r  
i  
p  
t  
i  
o  
n

-999 to  
9999

Contr  
ol loop  
setpoi  
nt.  
The  
locatio  
n of

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**the  
setpoint will  
be  
automatically  
set  
based  
on the  
control loop  
process  
variable.**

**0 to 9999**

**Reference  
number.**

**-999  
to  
9999**

**Operator  
input  
which  
can be**

**access  
ed by  
the  
host  
compu  
ter  
system  
.**

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## OPERATION

Once installation and setup and configuration are complete, the day to day operation needs of the UNIPRO depend upon the application. The basics are found in the Quick Reference Guide.

### TO RESPOND TO ALARM MESSAGES:

Note the alarm and determine what caused the alarm.

Press [ENTER] once to deactivate (silence) alarm relay contact and continue program execution.

After acknowledging the alarm, one of the following actions may be appropriate:

Abort the program by pressing the [Prog/Auto/Man] key.

In the case of a timed-out LIMIT statement (message #93), it is normally desirable to continue the program by re-executing the offending LIMIT statement to be sure it is satisfied. This is done automatically when the [ENTER] key is pressed to acknowledge the alarm.

If you do not want to re-execute the LIMIT statement, pressing the [SETPT] key will cause the LIMIT statement to be skipped and the program to continue to the next STEP.

Correct the problem or do what the programmed alarm indicates: see “Maintenance and Troubleshooting”: the alarm messages for complete information on programmed alarms. Then press [Enter] to continue the program.

If any alarm is only to be acknowledged and the operation is to continue, press [ENTER] to silence the alarm and then press [SETPT] to skip to the next operation.

## CHANGING THE SETPOINT AND THE REFERENCE NUMBER

[SETPT] is used to enter the setpoint, the Reference Number, and the Operator Inputs. The first press of [SETPT] will allow the arrow keys to adjust the value of the setpoint. Use the [LEFT ARROW] or [RIGHT ARROW] keys to select the character to be altered. Once the character to be changed is flashing, use the [UP ARROW] or [DOWN ARROW] keys to select the desired number or symbol. After all characters are as desired, press [ENTER] to place the value in nonvolatile memory and to continue paging through the parameters. Pressing [ENTER] again allows the Reference Number to be changed. Pressing [SHIFT] at any time allows the operator to “back up” to the to the step before [ENTER] was pressed. An additional press of [ENTER] allows the operator Input to be changed. Anytime during the setting of values [SETPT] may be pressed to save the value and exit. All the parameters in this group have a lock level of 3.

## SETPPOINT PARAMETERS

Display	Parameters	Description
Stpt		<p><b>Setpoint</b></p> <p>The SET display window line represents the basic parameter for the Control Loop that the process needs.</p>
	REF	<p><b>Reference Number</b></p> <p>Assigns a number to a program for future reference. These numbers can range from 0 to 9999.</p>
	NM	<p><b>Operator Input</b></p> <p>SET display window line = -999 to 9999. Allows the operator to enter information that may be needed by a program. This input may be used similarly to the reference number.</p>

## **PROG/AUTO/MAN**

**The Operation Mode for control of programs is selected by the [Prog/Auto/Man] key. Pressing this key allows access to the operation mode selection controls.**

**The first selection, after pressing [Prog/Auto/Man], allows for control of the program to be entered. The key presses that follow it depend upon the state of the program. If a program is not running see “Running A Program” below. Anytime during the selection process [Prog/Auto/Man] may be pressed to exit the selection process. All of the parameters under this key have a Lock Level of 3.**

## **MANUAL MODE.**

**In Manual mode the process variable is displayed in the PROCESS display, the SET display shows the appropriate control value, and no control action is computed. The arrow keys can also be used to activate the control output.**

Either the percent ON time (time-proportion) or valve position (position proportion) is displayed in the SET window. For single control mode operation this number is always positive (0/50/100). The [UP ARROW] and the [DOWN ARROW] keys increase or decrease the percent ON time or the valve position toward its fully opened or closed positions by approximately 1%. This continues for as long as the key is pressed. The [RIGHT ARROW] and [LEFT ARROW] keys force the CONTROL OUTPUTs to increase or decrease the percent output by approximately 10%.

### **AUTOMATIC MODE**

In Automatic Mode the process variable is displayed in the PROCESS display, the SETPOINT is displayed in the SET display, and control action is computed based upon the PID parameters and the input(s). Pressing and holding the [LEFT ARROW] key will cause the SET display to show the control action as described previously in "Manual Mode."



## PROGRAM OPERATIONS

### Running a Program

1. Press [PROG/AUTO/MAN] until the instrument's Prog LED lights.
2. The Program Number is displayed in the SET display, select the program to be run using the arrow keys.
3. **OPTIONAL:** If beginning at a step other than 1 Repeatedly press the [SHIFT] key to select the step upon which the program should start. The step number will appear in the PROCESS display.
4. Press [ENTER] to run the program.
5. If the Program Number in the SET display begins to flash, there is something wrong with the program (i.e. memory disruption, wrong command, etc.). Press the [PROG/AUTO/MAN] key to escape, or select a new program using the arrow keys. Troubleshoot the program and then restart this procedure.

### Stopping a Program

1. Press [PROG/AUTO/MAN] UNTIL either the Auto or Man LEDs begin to flash, indicating a program is in HOLD. Press [ENTER] to cancel the program (flashing will stop).  
OR

Press the [PROG/AUTO/ MAN] key until the Auto or Man LED is flashing, indicating a program is in HOLD. Return to the program mode by pressing [PROG/AUTO/MAN] and the PROCESS window will display the word HOLD. The SET window indicates the program number that is in hold. Press any of the arrow keys to cancel the program. The hold symbol will be replaced by the run symbol.

#### Placing a Program in HOLD

1. Press [PROG/AUTO/MAN] UNTIL the instrument is in either Auto or Man mode as indicated by the LEDs. The flashing LED signifies the program is in HOLD.  
OR  
Press [SHIFT]+[LEFT ARROW].

#### Note

If the instrument is in Manual mode and a program is in HOLD, no automatic control is taking place.  
If the instrument is in Automatic mode and a program is in HOLD, automatic control is continuing.

### Restarting a Program From HOLD

1. Press [PROG/AUTO/MAN] UNTIL the instrument is in Programmer mode as indicated by the Prog LED. The LED should be flashing signifying a program is in HOLD.  
OR  
Press [SHIFT] +[LEFT ARROW].
2. Do not alter the program number, otherwise, the program will start from the first step and not where it had left off.
3. Press [ENTER] and the program will continue executing with the step where the HOLD was initiated.

### To Enter Program Editor\*

1. Press Shift/Setpt
2. Select the program to be edited using the "arrow keys"(Edit / 0001)
3. Press Enter

\* Note that the unit will allow editing of a program that might be running. This editing will not affect the currently-running copy of this program until the program is actually restarted, either manually or by a program jump.

### To Edit Program Steps

1. Use the [LEFT ARROW] and [RIGHT ARROW] keys to select digits to be changed (either the OPCODE or the data)
2. Use the [UP ARROW] and [DOWN ARROW] keys to change the selected digit
3. Press [ENTER] to move forward to the next step, or
4. Press [Shift] to move backward to the previous step
5. If at any point the program does not advance or back up, and the entire SET display starts flashing,

**the data in the SET display is invalid for the OPCODE shown. Use the [arrow keys] to enter the correct data and then press [ENTER].**

**To Insert A Step**

1. Go to the step of the desired insertion, using either the [ENTER] or [Shift] keys
  2. Press [Control Parm]
  3. Enter the new step, OPCODE and data
  4. Press [ENTER]

**To Delete A Step**

1. Go to the step to be deleted, using either [Enter] or [Shift]
  2. Press [Alarm Set]

### To Exit the Editor Without Saving the Program

1. Press [Setpt ]at any time, the edited program is lost (the copy in non-volatile memory is unchanged)

### To Exit the Editor Saving the Program

1. Edit through step 19 as required, inserting NOP's wherever no operation is to be executed
  2. Press [ENTER]
3. Select the program number in the SET display using the [arrow keys] until the desired program number is being displayed (SAVE / 0000)
4. Press [ENTER], the program stored in that location previously is now lost (SAVE / Done)

## CHANGING PARAMETERS

All of the UNIPRO parameters, program numbers, OPCODES, and data values can be altered using the following procedure:

Press [Pr. Fact. / Ctrl. Param.]. The word MENU will appear in the PROCESS window. The Parameter group will appear in the SET window. Press [ENTER]. The symbol for the parameter is displayed in the PROCESS window while the current alterable data is shown in the SET window. The flashing character is the one that can be altered.

Use the [LEFT ARROW] or [RIGHT ARROW] keys to select the character to be altered. Once the character to be changed is flashing, use the [UP ARROW] or [DOWN ARROW] keys to select the desired number or symbol.

After all characters are as wanted, press the  
[ALARM SET] key to place the value in  
memory and exit,  
or  
press [ENTER] to save the value and continue  
(forward) editing other parameters,  
or  
[SHIFT] to save the value and continue (back)  
editing other parameters.

#### NOTE

If an entered number value is not within the acceptable data range, the maximum/minimum value will flash in the SET display. Repeat the above procedure until an acceptable value has been entered.

See “Setup and Configuration” for the Menu table and parameter definitions. The Alarms are also found there.

#### VIEWING A PROGRAM WHILE IT IS RUNNING

See “Status Display Page” in Maintenance and Troubleshooting



# Programmer Operations

## Introduction to Programming Techniques

The UNIPRO Programmer uses a step/OPCODE approach rather than a segment approach. The advantages of using OPCODES (operation code) are:

- 1) only what is to be changed is entered,
- 2) features can be added to older instruments, and
- 3) less information needs to be saved for each step therefore more programs can be stored.

The step approach is very similar to what an operator would do if he were manually controlling the process.

Some of the features in the OPCODEs may not be obvious as to how they would be used until more experience is gained. However, with a little practice and experimentation the Programmer can soon be mastered.

Each program in the UNIPRO consists of nineteen steps (one OPCODE per step). Some OPCODEs allow programs to be linked together. The UNIPRO can store up to 200 programs in non-volatile memory.

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## **Description of OPCODEs**

**The following "alphabet" lists all of the available OPCODEs for the UNIPRO Programmer.**

### **Programmer Alphabet**

**OPCO**

**A**

**A  
L  
A  
R  
M**

**0  
0  
0  
1  
-  
0  
0  
7  
9**

**8  
0  
-  
8  
3  
\***

**M  
E  
S  
S  
A  
G  
E**

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#  
S  
o  
u  
n  
d  
  
a  
n  
d  
  
d  
i  
s  
p  
l  
a  
y  
  
a  
l  
a  
r  
m  
  
t  
o  
  
s  
u  
m  
m  
o  
n

**o  
p  
e  
r  
a  
t  
o  
r  
  
a  
n  
d  
  
c  
o  
n  
v  
e  
y  
  
a  
  
m  
e  
s  
s  
a  
g  
e**

**b**

**BRAN**

**0000-0  
019**

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**Specifies an "if true" and "if false" step number to jump to based upon the previous condition (b TT.FF ).  
BRAN  
0  
branches out of the program.**

**Programmer Alphabet Continued...**

**OPCODE**

**C**

**AUXC  
N**

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**0-4000**

**Set Alarm 2 Setpoint value if Switch 7, Bank 1 is ON. If Switch 7, Bank 1 is OFF, interpreted as NOP.**

**d**

**ADDRESS**

**-128 to 127**

**Add to reference number.**

## E

### **EVEN T**

**1.0-15.  
1**

**Turns  
an  
output  
ON/O  
FF or  
waits  
for an  
input  
conditi  
on.  
The  
Progra  
mmer  
waits  
for an  
ackno  
wledg  
ment  
that  
the  
change  
has  
occurr  
ed  
before  
advan  
cing to  
the**



**next  
step.  
(.0 for  
OFF;  
.1 for  
ON)**

**G**

**GOSU  
B**

**0-201**

**Allows  
one  
program to  
execute  
another  
program and  
then  
continue.  
Any  
program can  
be  
called  
a  
subrou  
tine as  
long as  
it does  
not**

**call  
another  
r  
subrou  
tine.  
When  
a  
subrou  
tine  
ends,  
the  
calling  
progra  
m is  
reload  
ed and  
restart  
ed at  
the  
step  
followi  
ng the  
G  
OPCO  
DE. A  
GOSU  
B 201  
will  
cause  
a  
progra  
m to  
be  
called  
whose  
numbe**

<b>H</b>	<b>r is equal to the reference no.</b>
<b>h</b>	<b>TEMP S 0-4000 Set the temperature Setpoint.</b>
<b>I</b>	<b>TEMP I 0-4000 Check to see if the temperature is above specified value.</b>

**DELA  
Y**

**2-250  
sec**

**Insert  
a short  
delay  
in  
second  
s.**

**J**

**J  
U  
M  
P**

**0  
-  
2  
0  
1**

**J  
u  
m  
p  
  
t  
o**

a  
n  
o  
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h  
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p  
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**Programmer Alphabet Continued...**

**OPCODE**

**L**

**LIMI  
T**

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**.05-40.  
00 hrs**

**Limit  
the  
amount  
of  
time  
the  
Programmer  
should  
wait  
for  
something to  
happen  
before  
sounding an  
alarm.  
The L  
OPCO  
DE  
performs no  
operation by  
itself,  
it only  
performs a  
function  
when**

**used  
with  
another  
OPCODE.  
The  
data in  
a  
LIMIT  
statement  
may  
also be  
interpreted  
as  
Temperature.  
(Refer  
to  
"Effect  
of  
Limit  
Statement")**

**n**

**REF#  
S**

**0-255**

**Set the  
reference**

**nce  
numbe  
r.**

**O**

**OUTP  
UT**

**0000  
to  
0255**

**Set a  
value  
to be  
used  
for the  
selecte  
d  
Analo  
g  
Output  
t  
(XXX  
X).**

**o**

**OXIN  
Q**

**000.0  
to  
100.0**

**Test  
input  
b.**

**P**

**PID**

**0-999**

**Allows the Proportional Band to be altered by the Programmer. It is used in conjunction with = OPCODE.\***

**q**

**REF#I**

**0-4000**

**Test to see if the reference**



**number is above the specified value.**  
**r**

**RAMP**

**.05-40.00 hrs**

**Specifies the time(.05-40 hours) to ramp from the current temperature Setpoint to the new temperature Setpoint. Must be**

**followe  
d by  
an H  
OPCO  
DE.**

**S**

**S  
O  
A  
K**

**.  
0  
5  
-  
4  
0  
.  
0  
0**

**h  
r  
s  
.**

**S  
o  
a  
k**

**f  
o  
r**

**a  
s  
p  
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o  
d  
  
o  
f  
  
t  
i  
m  
e  
.**

**T**

**TIME  
S**

**0-40.0  
0 hrs**

**Set the  
master  
timer  
to the  
specifi  
ed  
value  
for  
count  
down.  
If the  
set  
value  
is 0,  
the  
timer  
will  
count  
up to a  
maxim  
um of  
99.99  
hours  
and  
HOLD**

**.**

## Programmer Alphabet Continued...

### OPCODE

t

T  
I  
M

**E  
I**

**0  
-  
4  
0  
.  
0  
0**

**h  
r  
s**

**C  
h  
e  
c  
k**

**t  
o**

**s  
e  
e**

**i  
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**t  
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t  
i  
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**U**

**U  
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**C  
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**\* Refer to NOTE at the end of this section for further information.**

**Note:**

**The P and = OPCODEs are used together as shown in the following example which enters values for the Pb=150, Reset=.3, Rate=.05, LOPO=20 and HIPO=95**

<b>01</b>	<b>P</b>	<b>0150</b>	<b>Pb=150</b>
<b>02</b>	<b>=</b>	<b>0030</b>	<b>Reset=.30</b>
<b>03</b>	<b>=</b>	<b>0005</b>	<b>Rate=.05</b>
<b>04</b>	<b>=</b>	<b>0020</b>	<b>Minimum %Output=20%*</b>
<b>05</b>	<b>=</b>	<b>0095</b>	<b>Maximum %Output=95%*</b>
<b>06</b>	<b>=</b>	<b>0016</b>	<b>Cycle Time=16</b>

**\* When altering the above parameters, note that no decimal point appears.**

**Note:**

The execution of a **JUMP** or a **GOSUB** statement always loads the program into working memory whereas an unconditional **BRANCH** statement does not reload the program.

Note that the Programmer counts time in hours, tenths of hours (=6 minutes) and hundredths of hours (=36 seconds) rather than in hours, minutes, and seconds.

**Symbol Table of OPCODEs****DISPLAY SYMBOL****PROGRAM  
MER OPCODE**

A
---

**A-ALARM****b-BRAN****C-AUXCN****d-ADREF****E-EVENT****F-FSOAK****G-GOSUB****H-TEMPS**

**h-TEMPI**

**I-DELAY**

**J-JUMP**

**L-LIMIT**

## Symbol Table of OPCODES Continued....

**DISPLAY SYMBOL**

**PROGRAM  
MER OPCODE**

**n-REF#S**

**O-  
OUTPUT**

**o-  
OXINQ**

**P-PID**

**q-REF#I**

**r-RAMP**

**S-SOAK**

**T-TIMES**

**t-TIMEI**

**U-TOUTI**

**Y-AUXI**

**==PIDEQ**

**--NOP**

## Limit Statements

There are various ways to force a program to wait for something to happen. Although it may seem that the specified condition should be easily satisfied, it is still wise to put realistic time limits on how long the wait should be. The following chart summarizes the effect the LIMIT statement has on each OPCODE.

### Effect of Limit Statement on OPCODES

OPCODE	Effect of Limit Statement
A	Effective with alarm codes 80 and 81. An 80 or 81 -- limit statement sets deviation band in degrees, decimal point is ignored (i.e. 1.00 is 100 degrees)
b	No Effect*
C	No Effect*
d	No Effect*
E	No effect on event output. On event input, sets the maximum amount of time to wait for that event to occur. An alarm 93 is displayed or sounded.**
G	No Effect*
H	Forces a wait and sets the maximum amount of time to wait for the temperature to reach setpoint +10 F(+5 C).**
h	Sets maximum time to wait for a condition to be met.**
I	No Effect*
J	No Effect*
L	No Effect*
n	No Effect*

<b>o</b>	<b>Sets the maximum time to wait for a condition to be met.*</b>
<b>P</b>	<b>No Effect*</b>
<b>q</b>	<b>No Effect*</b>
<b>r</b>	<b>ILLEGAL! An r OPCODE must always be followed by an H OPCODE.</b>
<b>S</b>	<b>No Effect*</b>
<b>T</b>	<b>No Effect*</b>
<b>t</b>	<b>Sets maximum time to wait for a condition to be met.**</b>
<b>U</b>	<b>Sets maximum time to wait for a condition to be met.**</b>
<b>Y</b>	<b>Sets the maximum time allowed to wait for a condition to be met.*</b>
<b>=</b>	<b>No Effect*</b>
<b>-</b>	<b>No Effect*</b>

**\* When a LIMIT statement follows this OPCODE it is interpreted as a NOP.**

**\*\* An alarm 93 is displayed and/or sounded only if the limit statement is not followed by a branch. If the condition is not met by the time listed in the data statement, the unit will display and/or sound an Alarm #93. If the alarm need only be acknowledged and operation is to continue, press Enter once to silence the alarm and then press Setpt to skip the LIMIT OPCODE and resume operation.**



**The operation of a limit statement after the following OPCODEs is described in more detail below:**

**E (EVENT) (INPUT)**

**- A limit statement here will cause the program to wait for the specified event INPUT (normally event numbers 8-15) to switch to the specified state (ON OR OFF, 1 OR 0), before proceeding. If this does not occur within the specified limit time, a limit time-out alarm will occur.**

**Note: The event INPUT must be held in the trip state for at least 30 seconds to make sure that the Programmer will acknowledge it. Thus, a momentary push button could not be used as an event INPUT unless some type of latching scheme is employed. If a limit statement is not used, the program may wait indefinitely.**

## **H (TEMPS)**

## **A limit statement**

here will cause the program to wait for the measured temperature to come to within +10 F (or +10 C) of the specified Setpoint. If this does not occur within the specified limit time, a limit time-out alarm will occur. If no limit statement is used, the Programmer simply sets the specified Setpoint and goes on to the next step. The maximum time that a limit statement will accept is 40 hours. Use the Programmer Status Display during a wait operation to reveal the time left before a limit time-out alarm will occur.

## **Branch Statements**

Branch statements are best utilized when placed after inquiry statements. If neither a branch nor a limit statement is placed after an inquiry the Programmer will sit at the inquiry line indefinitely. A branch statement can immediately follow an inquiry or it can be placed after the limit statement, for example:

**INQUIRY    or    INQUIRY**  
**BRANCH        LIMIT**

## **BRANCH**

The effect of a branch after an inquiry is to jump to a specific line in the program based upon the outcome of the inquiry. The format of the branch OPCODE is b TT.FF; therefore if the outcome is true the program jumps to the step number listed first. Whereas, if the outcome is false, the program jumps to the second step.

**A limit statement between an inquiry and a branch just sets a definite time to wait for the inquiry to become true. It has no effect on the outcome of the inquiry or where the program branches to. It only effects the length of the time delay.**

**If a branch statement is not preceded by an inquiry, or any conditional statement, the branch is automatically assumed TRUE.**

**An unconditional branch is one in which the steps specified for true and false are the same. An unconditional branch to step 1 (b 01.01) will cause a program to loop back to the beginning of the program every time the above statement is encountered.**

**The difference between a b 01.01 and a J 0000 is that the jump reloads the program and would therefore pick up any changes edited into the program after it was initially started.**

## **Writing and Editing a Program**

### **Writing**

**Before a program can ever be written into the UNIPRO, the author must understand and perform the following process:**

- 1. Determine what the program is to do,**
- 2. Write, revise, and rewrite an algorithm (program in words) until part 1 works,**
- 3. Construct the program for the UNIPRO using the OPCODEs listed in "Programmer Alphabet".**

**The Programmer Editor can be used to create a new program or modify an already existing program. While in Program Edit mode, the unit continues to control the furnace (as long as the Auto LED is on), and a running program continues if the program LED is on.**

### **The Editor Mode:**

To get the unit into the editor mode, perform the dual-key operation [Shift][Setpt.] The PROCESS window will have the message EDIT displayed and the SET window will have a XXXX displayed signifying the program number to be edited. At this point any of the 200 programs can be called into the edit space using the arrow keys to change the necessary digits. That is, the [left arrow] or [right arrow] keys can be used to select the digit to be changed and the [up arrow] or [down arrow] keys can be used to select 0 through 9. Next, press the [Enter] key once more to begin entering or modifying the program. The PROCESS display will show step 01. The OPCODE character is also displayed in the PROCESS display while the SET display will show the DATA line in various formats depending on the OPCODE character. To advance through each step of the program use the [Enter] key; to move backwards in the program use the [Shift] key.

At any point, a step can be inserted or deleted. To insert a step, press Control Parm, this forces the OPCODE at step 19 to be lost and a -(NOP) will appear. To delete a step, press [Alarm Set key], this causes a - NOP to be pulled in at step 19.

Use the [left arrow] or [right arrow] keys to determine whether the OPCODE or DATA is to be changed. If a data character is flashing move left or right in the data by using the arrows. If the OPCODE needs to flash press the [left arrow] until the OPCODE character flashes the [right arrow] does not allow access to the OPCODE. If the OPCODE is to be changed, the [up arrow] or [down arrow] keys can be used to scroll through the OPCODES alphabetically. If either the "up arrow" or "down arrow" keys are held down, the OPCODEs will automatically be displayed with each flash of the display. When entering data, the "up arrow" and "down arrow" keys can be used to select 0 through 9 (or negative sign, if applicable).

If at any point [Enter] or [Shift] is pressed and the SET display starts flashing, the data is not valid for the OPCODE shown. Use the arrow keys to alter the data as required and press [Enter] or [Shift] to continue entering or editing the program.

## Exiting

Once all 19 steps have been entered or modified as needed and the editor is sitting at step 19, press [Enter] one more time to get the message SAVE displayed in the PROCESS window. The program number, the number of the program originally pulled into the edit space, will appear in the SET display but can be changed using the arrow keys.

If the program number is changed at this point, however, the edited program will be stored as the new number. For example, it is possible to call up program #29, edit it, and store it back as program #4. The original #29 is still intact, and whatever was in program #4 is now replaced with the edited #29.

If, while entering data an error is made, or it is desired to exit the editing routine without making any changes, press Setpt and the unit will continue normal operation. The edited information will be lost.

### NOTE:

It is recommended that program #200 be kept as a "garbage" program location to temporarily store programs as required.

Programmer messages are displayed when inputting data and using the Editor, refer to the table shown below:

## **Explanation of Programmer Messages**

**DISPLAY MESSAGE**

**EDIT**

**SAVE**

**RUN**

**HOLD**

## **Effect of Start-up Sequence on Programmer**

**The two start-up options described in "Start-Up Procedures" affect the Programmer significantly.**

**If a Shift-Shift-Enter start-up was used, the program running at the time of power was lost will pick up where it left off. This includes events and soak times will be picked up with an accuracy of +4.8 minutes.**

**If a simple Enter-Enter start-up sequence was used, the program is canceled. All events will return to the rest position (OFF) and the setpoint is lost.**



## Alarm Messages

**Programmer alarms interrupt Manual display, as discussed in "Keyboard Operations". This prevents important error messages from being lost while the Manual display is activated.**

**Once any of the following alarms are displayed and/or sounded, the dual-key operation Shift/"down arrow" cannot be used until the alarm is silenced by pressing Enter. This does not clear the alarm, however.**

**Programmer Alarms appear at Event 0 on the Optomux board.**

To respond to alarm displays (#01-#98)

- 1. Press Enter one time to deactivate alarm relay contact (silence).**
- 2. Examine the display to determine the origin of the system alarm:**

**Messages #01-79:**

**Indicate a programmed alarm (from an "A-ALARM" OPCODE in the program) has occurred. The response should be to carry out whatever task the message code indicates. For example, Message #37 might mean put test pins in furnace, while #28 might mean to manually change the temperature setpoint to 1550`F. These codes should\d be assigned for the particular installation involved.**

**Message #80-#81:**

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Used, in conjunction with the Programmer, for the following purpose:

- 81      TURN ON A TEMPERATURE  
DEVIATION BAND ALARM  
(COMMUNICATING TEMPERATURE  
CONTROLLER REQUIRED)**
- 80      TURN OFF SAME**

The A(Alarm) OPCODE in this case should be followed by the L(Limit) OPCODE that sets the width of the particular deviation band (i.e. +10`,+25` or +12%C, etc.). If no LIMIT statement is used, the previous deviation value will be used. Both the turn ON and turn OFF statements can set the deviation. The alarms are said to be "smart" in the sense that they are not armed until the process is actually at the required setpoint. If tripped, the alarms produce the standard programmer ALARM display and pulsing alarm. The program remains in HOLD until action is taken.

Also, after the Deviation Alarm 81 occurs, clearing the alarm also clears the inb and flag; therefore, the process must reach setpoint before the alarm can sound again. The alarm is automatically disarmed at the end of a program.

**Message #82-90:**

Not assigned.

**Message #91:**

Reserved

**Message #92:**

Indicates a problem on the Events Buss. This error may occur at any point in a program that attempts to use events statements.

One of the following conditions possibly exists:

- a.      The OPTOMUX board of interest is not present, is disconnected, or is turned off.

**b. The jumpers on the events board are improperly set. Should be configured for:**

- 2 pass format**
- 1200 baud**
- Address #1**
- Multidrop Mode**

**c. There is severe disruption of communication due to use of wrong cable, too long a cable run, routing of cable in non-recommended termination schemes (i.e. WYE), or improper or missing termination resistor connections.**

**Message #93:**

**Indicates a limit statement has timed out. This must be interpreted in the particular situation, but if the limit time specified in the program was realistic, then a flaw in the system is indicated, or an instrumentation or operator error has occurred.**

**Message #94:**

**Not assigned.**

**Message #95:**

**Indicates an illegal ramp, the r OPCODE is not followed by the H OPCODE in the currently running program.**

**Message #96:**

**Indicates that a power failure has occurred and the UNIPRO started up again in the AUTO RESTART mode as determined by DIP Switch 5 on Bank 1.**

**Message #97:**

**Indicates that a subroutine is calling a subroutine which is illegal with the MMI Programmer.**

**Message #98:**

**Indicates that a jump from one program to another was attempted but not implemented due to memory disruption or a J201 to reference number too large.**

**Message #99:**

**Not assigned.**

3. **After taking the required action based upon the alarm message, there are several possible courses of action:**
  - a. **Press Enter again to continue with the program (after either correcting the problem with the temperature or events buss in the case of error message #92, or taking the prescribed action in the case of programmable messages 01 through 89).**
  - b. **Abort the program by pressing PROG/AUTO/MAN.**
  - c. **In the case of a timed-out limit statement, (message #93), it is normally desirable to continue the program by re-executing the offending limit statement to be sure it is satisfied. To do this, simply press Enter. A setpoint will cause the LIMIT statement to be skipped and the program to continue on the next step.**

## Status Display Page

The status display is broken into “pages” and “paragraphs” the “pages” are represented here by columns and the “paragraphs”, by the individual cells. See “Setup And Configuration” for the values displayed here most of the status pages correspond to the setup menus.

Press [Shift]+[ ] to enter the page display table.  
Press [ ] to move from one column to the next in the display. Press [ ] to move down a column.

PROG	EVNT	DATA	EXT ALOG	CONT	(generic)	SLVE INST
R ? P???	EVSP ////	CJ ????	EA 0 ????	PO ????	00 = 0 C11C	HSP1 .???
G ? p???	EVAC ////	IN A ????	EA 1 ????	PB ????	: :	HAC: ????
- ????	EVST X ??	IN B ????	EA -- ????	RES ????		HPO: ????
RT ????		IN C ????	----	RAT ????		**
MT ????			----	CYC ????		**
PAL			----	LOPO ????		**
			----	HIPO ????		HST1 G ??

				EA 15 ????	LDLN ????		----
				ST A X ??	SW ????		HST :

**NOTES:**

---- The item displayed in the box above this repeats through the full cycle of options. For example: Exterior Analog has 16 displays and Slave Instrument has 8.

\*\* Items displayed above this repeat in sequence through the full cycle of options. For example: Slave Instrument will display data for HSP, HAC, And HPO for each option in the cycle before going to the next option.

: The Generic table (the title of this page does not display) displays the parameters in hex for all the programs loaded into the UNIPRO 3.5

. These are for engineering troubleshooting purposes only. The operator should not try to use these.

## **Calibration Procedures**

**The UNIPRO instrument is shipped completely precalibrated. The drift characteristics of the input circuits are excellent but from time to time adjustment may be necessary in order to maintain high accuracy.**

### **Analog Input Calibration.**

**There are three analog inputs and a cold junction compensation sensor on the UNIPRO. The input level and input features for each input are determined by changeable daughter boards that are mounted piggy back on the analog input board. There are several types of input daughter boards: thermocouple input, auxiliary input, 4 to 20 mA input, 0 to 10 V linear, RTD, and slide wire input.**

**The standard factory configuration is for input A to be a thermocouple input, input B to be an Oxygen probe input(auxiliary input) board, and input C to be a slidewire feedback input. If the instrument to be calibrated does not have the standard factory configuration, then identifying the configuration is necessary so that the proper procedure for each input board can be followed.**

### **Calibration Displays And Keyboard**

**When operating in the calibration mode, the displays and front panel keys take on special assignments. The PROCESS display shows the value of the input being calibrated with a flashing digit. This flashing digit shows the relative sensitivity of the arrow keys, as**

**described following the key descriptions. The SET display shows which input is being calibrated and whether the zero value or the span value is being modified.**

**The SET display messages are shown below:**

<b>Message</b>	<b>Description</b>
<b>Z-A</b>	<b>Zero input A</b>
<b>Z-B</b>	<b>Zero input B</b>
<b>Z-C</b>	<b>Zero input C</b>
<b>Z-SW</b>	<b>Zero slide wire (from input C)</b>
<b>S-A</b>	<b>Span input A</b>
<b>S-B</b>	<b>Span input B</b>
<b>S-C</b>	<b>Span input C</b>
<b>S-SW</b>	<b>Span slide wire (from input C)</b>

### **NOTE**

**It is very important to be sure the SET display is showing the proper mode before making an adjustment or the wrong value will be changed.**

### **Adjustment Sensitivity**

**The adjustment sensitivity works in the following manner. If the digit farthest right in the process display is flashing, then each press of the [Up Arrow] or [Down Arrow] key will change the calibration value shown by one unit. This is the least sensitive position. If the digit farthest left is flashing, then each press of**

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**the [Up Arrow] or [Down Arrow] key will change the calibration value by a thousand units. The middle digits will show sensitivities of a hundred and ten units respectively. It is not important to know the relative worth of one calibration unit. Understanding that the location of the flashing digit affects change that one key press will make on the calibration value is necessary. By observing the degree of sensitivity one key press makes at each flashing digit location, you can quickly see how to use this feature.**

## **Preparing For Calibration**

**Before placing the UNIPRO into calibration mode, check to be sure that for each input:**

**The proper thermocouple type has been selected, and**

**Cold Junction compensation has been selected, if required. Cold Junction compensation can be selected by using the [Setup] key. The option is below the corresponding input type selection.**

**The UNIPRO is placed into calibration mode by connecting a jumper from TBD-17 to TBD-18. To make sure of the integrity of the calibration factors, power should be applied to the UNIPRO before this jumper is installed and not removed until after this jumper has been removed. The UNIPRO should be operating for at least 30 minutes before calibration to make sure that input circuits have stabilized.**

**For each input of the UNIPRO, follow the calibration procedure by the type of input board installed for that input. Once an input has been calibrated, be sure to press the [Enter] key to make sure that the latest calibration factors are stored.**

## **Calibration Of The Thermocouple Board**

**This calibration procedure assumes that a thermocouple has been selected and internal cold junction compensation is being used. If this is not true, follow the procedure for the auxiliary board using a 0 to 40 millivolt signal. The calibration procedure is as follows:**

**Connect the input to be calibrated to a junction compensated calibrator (IE: Biddle Instrument Co. Versa-Cal Calibrator) using the proper extension wire for the thermocouple type selected.**

Using the [Display] key, select the proper input to be calibrated (input A, if standard configuration).

Using the [Enter] key, select the zero mode (IE: if for input A, Z-A).

Set the calibrator output to the recommended zero value for the thermocouple type selected. See the table below.

Using the Arrow keys, adjust the process value to equal the calibrator output.

Press the [Enter] key to select the span mode (IE: S-A, for input A).

Set the calibrator output to the recommended span value in for the thermocouple type selected.

Using the arrow keys, adjust the process value to equal the calibrator output.

Repeat steps f. through j. until no additional change is needed.

Press the [Enter] key one more time to be sure the calibration factors are stored. Go to the next input to be calibrated or exit calibration mode by removing the calibration jumper or pressing [Setup] .

Thermocouple type	Zero °F(°C)	Span°F ( C)
B	200 (90)	3000 (1800)
C	32 (0)	3000 (1800)
E	32 (0)	1300 (900)
J	32 (0)	1300 (900)

<b>K</b>	<b>32 (0)</b>	<b>2300 (1200)</b>
<b>N</b>	<b>32 (0)</b>	<b>2300 (1200)</b>
<b>NNM</b>	<b>32 (0)</b>	<b>2000 (1100)</b>
<b>R</b>	<b>300 (150)</b>	<b>3000 (1800)</b>
<b>S</b>	<b>300 (150)</b>	<b>3000 (1800)</b>
<b>T</b>	<b>32 (0)</b>	<b>700 (350)</b>

**The usable ranges of the thermocouple types are shown in The table above. If having a high accuracy over a specific operating range is desirable then the input should be calibrated over that range. Follow the calibration procedure for normal calibration with the following changes. Use the low end of the desired range as the zero value and the high end as the span value. There will be more interaction between zero and span with this method. The desired operating range must fit with the limits of the table.**

## **Oxygen /Auxiliary Board Calibration**

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## **To Zero the board calibration**

**Turn off the power at the simulator.**

**Short the input by putting a banana plug shorting block into the simulator. Short the jumper ( switch) wired into 17 and 18 to calibration mode.**

**This will produce some value in the PROCESS window and Z-A in the SET window.**

**Use the left and right arrow keys to change the adjustment from coarse to fine in the PROCESS window, and the up and down arrow keys to change the value. Adjust the PROCESS window value to zero (0), or as close as possible.**

**Press the [Enter] key twice to store the value.**

**Press the [Display] key to change the SET window to Z-B or Z-C and repeat steps 4 and 5 for inputs B and C.**

**After all the values are stored, press the [Display] key to return the SET window to Z-A and press the [Enter] key to change it to S-A (span).**

**To set the span**

**Put the meter leads into the banana plug to measure mV (300----).**

**Remove the jumper block from the simulator.**

**Using a meter to check your input voltage on the O2 side, enter 1.4 or 1.5 mV from the simulator, and turn ON the simulator.**

**Set the span values at 1400 or 1500 (depending on what the simulator generated) using the arrow keys to adjust the values.**

**Press the [Enter] key twice to save the values and press the [Display] key to change the input type.**

**Repeat steps 1-5 for each input (A, B, and C), pressing [Enter] twice to save the values each**

**time. Wait 5 to 10 seconds to allow the reading to record, then take it out of calibration mode by throwing the switch.**

**Remove the banana plugs from the simulator (remove the load from the line) and wait for the instrument to "max out" at 3500.**

**Let the reading settle at maximum (another 5 to 10 seconds) then reinsert the banana plug into the simulator to see if the instrument returns to a steady 1500 at all inputs.**

**Vary the input millivoltage down and verify that 1500 reduces to 1000 at a steady level for each input setting.**

**Check the reference voltage on TBD-5 and 6 (for input B) and 8 and 9 (for input C). Should read around +2 mV (between 1.8 and 2.2 is considered good).**

## **Slidewire Board Calibration**

### **Zero**

**Turn off the power at the simulator.**

**Short the input by putting a banana plug shorting block into the simulator. Short the jumper ( switch) wired into 17 and 18 to calibration mode.**

**This will produce some value in the PROCESS window and Z-A in the SET window.**

**Use the left and right arrow keys to change the adjustment from coarse to fine in the PROCESS window, and the up and down arrow keys to change the value. Adjust the PROCESS window value to zero (0), or as close as possible.**

**Press the [Enter] key twice to store the value.**

Press the [Display] key to change the SET window to Z-B or Z-C and repeat steps 4 and 5 for inputs B and C.

After all the values are stored, press the [Display] key to return the SET window to Z-A and press the [Enter] key to change it to S-A (span).

## Span

Put the meter leads into the banana plug to measure mV (300----).

Remove the jumper block from the simulator.

Using a meter to check your input voltage on the O2 side, enter 1.4 or 1.5 mV from the simulator, and turn ON the simulator.

Set the span values at 1400 or 1500 (depending on what the simulator generated) using the arrow keys to adjust the values.

Press the [Enter] key twice to save the values and press the [Display] key to change the input type.

Repeat steps 1-5 for each input (A, B, and C), pressing [Enter] twice to save the values each time. Wait 5 to 10 seconds to allow the readings to record, then take it out of calibration mode by throwing the switch.

Remove the banana plugs from the simulator (remove the load from the line) and wait for the instrument to "max out" at 3500.

Let the reading settle at maximum (another 5 to 10 seconds) then reinsert the banana plug into the simulator to see if the instrument returns to a steady 1500 at all inputs.

Vary the input millivoltage down and verify that 1500 reduces to 1000 at a steady level for each input setting.

Check the reference voltage on TBD-5 and 6 (for input B) and 8 and 9 (for input C). Should read around +2 mV (between 1.8 and 2.2 is considered good).

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# Digital Interfaces

## Host Communications

The Host communications are able to be set from the front panel: see “Setup and Configuration”. The UNIPRO is suitable for connection to a host computer for intelligent overall process monitoring or supervision. Terminal connections are made on the rear panel: See the connections label on the instrument. Twisted pair wire with or without a shield must be used for all communications wiring. Conventional RS-232 cable is required along with a half-duplex RS-232/422 convertor (P/N FG/500-0501). With a 9-Pin or 25-Pin female connector depending on Host Computers connector, some of the pins on the computer end of the connector should be jumpered together as follows: 9-Pin: 1,4,6,8 or 25-Pin: 5,6,8,20. The UNIPRO never initiates

**communications, and is always in receive mode unless responding to a question.**

## **"X" Protocol**

**The "X" protocol software involves a Parameter Table, a Program Run Buffer, a Program Edit Buffer, and a Serial I/O Program Buffer. The UNIPRO can be written to using a "1TXparameternumber\$data" format. This entry would place the data value in the proper location as determined by the parameter number. Any parameter can be read back from the UNIPRO using the following format "1Txparameternumber". Therefore, to write a value to the UNIPRO for a specific parameter use an "X" or to read a specific parameter from the UNIPRO, use an "x".**

**All of the parameters are listed below along with a short description. The numbers in the parenthesis are in Hexadecimal.\***

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**Parameter Table****(0H-2FH) & (72H-79H)****CHSTAT (0)****-Status Word****SETPT (1)****-Setpoint of Process  
Variable****SETPTOS (2)****-Setpoint Offset****GAIN (3)****-PID Proportional Band****RESET (4)****-PID Reset****RATE (5)****-PID Rate****CYCTIM (6)****-PID Cycle Time****ALARM1 (9)****-ALARM1 Value and Type****ALARM2 (0AH)****-ALARM2 Value and Type****Parameter Table****continued...****(0H-2FH) & (72H-79H)****REFNUM (0CH)****-Reference Number****PRGNUM (0DH)****-Program Number and Step****PRGS****TK****(0EH)****-****Progra****m****Stack**

	(Number and Step)	
		<b>PRGMT (0FH) -Master Timer Bit 15 is DIR Flag</b>
		<b>PRGRTIM (10H) -Programmer Course Remaining Time</b>
<b>EVSETPT</b>	<b>(11H)</b>	<b>-Events Buss Setpoint</b>
		<b>PTDALM (14H) -Programmer Temperature Deviation Alarm Value and Condition</b>
<b>RAMPTIM</b>	<b>(15H)</b>	<b>-Programmer Ramp Time</b>
		<b>RAMPST (16H) -Programmer Ramp Starting Temperature</b>
		<b>RAMPDIF (17H) -Programmer Difference and Direction</b>
<b>TEMP</b>	<b>(19H)</b>	<b>-Temperature</b>
		<b>COLDJCT (1AH) -Temperature Compensation Value</b>
<b>AUXIN</b>	<b>(1BH)</b>	<b>-Auxiliary Input</b>
<b>DIPSW</b>	<b>(1EH)</b>	<b>-DIP Switch Image, bit map</b>
<b>ALRMCON</b>	<b>(1FH)</b>	<b>-Alarm Conditions</b>
<b>PERRCUR</b>	<b>(21H)</b>	<b>-Current Process Error</b>
<b>PERRNO</b>	<b>(22H)</b>	<b>-Process Error (N)</b>
<b>PERRN1</b>	<b>(23H)</b>	<b>-Process Error (N-1)</b>
<b>PERRN2</b>	<b>(24H)</b>	<b>-Process Error (N-2)</b>
<b>CONACC</b>	<b>(25H)</b>	<b>-Control Action Accumulator</b>
		<b>RLYTIM (26H) -Relay ON Time and OFF Time</b>
<b>RLYCON</b>	<b>(27H)</b>	<b>-Control Action</b>
<b>CONACTIM</b>	<b>(28H)</b>	<b>-Control Action Timer</b>
<b>EVPAR</b>	<b>(29H)</b>	<b>-Events Partition Bit Map</b>
<b>EVSTAT</b>	<b>(2AH)</b>	<b>-Events Buss Status</b>
<b>EVACT</b>	<b>(2BH)</b>	<b>-Actual Events Buss</b>
<b>CONSUM</b>	<b>(72H)</b>	<b>-Control Summers</b>
<b>DACV1</b>	<b>(73H)</b>	<b>-DAC1 Data</b>

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**DACV2 (74H) -DAC2 Data**  
**ALRMQ (75H) -Programmer Alarm**  
**HPOUT (76H) -Temperature Percent Output**

**PROGRAM RUN BUFFER (30H-45H)**

**PRUNPRG** Program Number and Step, Remaining Time, First Through Last Steps of Program Along With Opcodes, and Checksum and

**PROGRAM EDIT BUFFER (46H-5BH)**

**PEDPRG** Program Number and Step, First Through Last Steps of Program Along With Opcodes, and Checksum and Allow Byte  
**\*\*Location 91 is not used**

**SERIAL I/O PROGRAM BUFFER (5CH-71H)**

**PSIOPRG (50)**

Program Number and Step, First Through Last Steps of Program Along With Opcodes, and Checksum and Allow Byte

**\* Refer to Appendix A for further information on Hexadecimal Code.**

**\*\* An Alarm Queue is included in the host communications capabilities of the instruments. The Alarm Queue is simply a block of storage locations for the programmer alarms that occur within the instrument and works similar to the idea of FIFOs (first in, first out). The queue was added because various programmer alarms can occur and be acknowledged and/or corrected before the Host**

Software ever has the chance to "see" them. Therefore, the alarms had to be passed on to the Host Software even if they were already acknowledged and/or corrected. The Alarm Queue was created to meet this need.

The Alarm Queue works on a READ & CLEAR basis. If the Alarm Queue is read with the "x" parameter FF (Hex), the storage location will return a word comprised of a HI byte and a LO byte. The LO byte is the first alarm appearing in memory while the HI byte is the second alarm appearing in memory (thus creating the FIFO effect). If both bytes are non-zero, then the Host will look again to see if any non-zero values have been stored. Once the bytes are read from the Queue, they are cleared out of the memory block.

If there is no Host Software used, the Alarm Queue is never read, but the Queue is still written to by the instrument. Once the Queue is filled, it cannot be written to until a location has been cleared. Considering the fact that Host Software is not used, the Queue will never be cleared and will never store any of the alarms that occur after the Queue has been filled. This does not cause a problem considering the fact that the Queue is only used with Host Software and if the software is not used, we do not care if it is filled or not.

# Message Protocol Format AICddddDLE

**End of Transmission (EOT)**

**HEX(04).**

**LRC is the result of an XOF function performed on all previous characters in the message.**

**Delimiter marks the end of DATA and signals the upcoming EOT character.**

**NULL HEX(00) or Backspace HEX(08)\***

**\*If LRC was going to be on EOT HEX(04)**

**then D = HEX(08).**

**Data character, definition based on the C (command) character.**

**Command character  
from the command  
set table**

**Instrument prefix**

**Address of unit  
based, on SIO setup  
Possible inputs are**

**ASCII**

**0 6 B  
1 7 C  
2 8 D  
3 9 E  
4 A F  
5**



# Host Software

## 10PRO Emulation Mode

The UNIPRO will emulate the 10PRO temperature controller command set. The commands which are emulated are:

### 10PRO Temperature Controller Command Set

Command Letter	Description
<b>p</b>	<b>Read Auto/Manual mode</b>
<b>o</b>	<b>Read Remote/Local</b>
<b>I</b>	<b>Read Remote Setpoint</b>
<b>h</b>	<b>Read Local Setpoint</b>
<b>I</b>	<b>Update Remote Setpoint</b>
<b>J</b>	<b>Update Remote Setpoint</b>
<b>l</b>	<b>Read Temperature</b>
<b>m</b>	<b>Read % Output</b>
<b>P</b>	<b>Update Auto/Manual mode</b>

### Command Set

The MMI command set supports the extensive capabilities of the UNIPRO when used with a supervisory computer software system such as MMI's Process Master. The command set consists of the following characters:

### MMI Command Set

Update	Read	Description
	<b>A</b>	<b>a</b> <b>Alarms</b>
	<b>D</b>	<b>d</b> <b>Derivative</b>
	<b>E</b>	<b>e</b> <b>Memory</b>
	<b>*</b>	<b>g</b> <b>Auxiliary</b>
	<b>Input</b>	
	<b>I</b>	<b>I</b> <b>Integral</b>
	<b>(Reset)</b>	
	<b>*</b>	<b>j</b> <b>Event Inputs</b>

<b>K</b>	<b>k</b>	<b>Event</b>
<b>Outputs</b>		
<b>L</b>	<b>l</b>	<b>Program</b>
<b>Number</b>		
<b>M</b>	<b>m</b>	<b>Mode</b>
<b>N</b>	<b>n</b>	<b>Program Step</b>
<b>Number</b>		
<b>P</b>	<b>p</b>	<b>Proportional</b>
<b>Band</b>		
<b>Q</b>	<b>q</b>	<b>Memory</b>
<b>Update</b>		
<b>R</b>	<b>r</b>	<b>Remote</b>
<b>Program Access</b>		
<b>S</b>	<b>s</b>	<b>Setpoint</b>
<b>*</b>	<b>t</b>	<b>Temperature</b>
<b>U</b>	<b>u</b>	<b>Status</b>
<b>V</b>	<b>v</b>	<b>% Output</b>
<b>X</b>	<b>x</b>	<b>Parameters**</b>
<b>Z</b>	<b>z</b>	
		<b>Communications mode</b>
<b>*</b>	<b>w</b>	<b>Read DIP</b>
		<b>Switches</b>

\* **Update Not Allowed**

\*\* **See X Protocol Section**

## **OPTOMUX Protocol**

The OPTO 22 format is RS-422, Full-Duplex, 1200 BAUD, 8 bit, no parity, and 1 stop bit. The message format follows the OPTOMUX two pass protocol. The UNIPRO sends messages to set up the events board per the events partition, activate the appropriate outputs, and reads the input conditions. The UNIPRO initiates messages on this buss and waits 1/2 second for a reply.

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The Events Buss allows the Controller to receive and/or transmit discrete events in time. The XMT and REC LEDs indicate whether the OPTOMUX is transmitting or receiving data. (These LEDs should never be on at the same time.) This actual input/output switching is executed by the OPTOMUX board: see “Setup and Configuration” or “Programmer Operations” or the OPTO22 manual for specific details.

### Slave Buss

The slave buss is a broadcast only communications buss.

### Broadcast Mode

The slave buss broadcasts the UNIPRO setpoint using the 10PRO broadcast protocol. The broadcast protocol format is similar to the message protocol format. Its form is

**?AddddDLE**

where

<b>?=</b>	<b>10PRO address</b>
<b>symbol</b>	
<b>A=</b>	<b>Using 10PRO</b>
<b>I=</b>	<b>Sending Setpoint</b>

**dddd= Data for Setpoint**

## Passwords

In “Setup and Configuration” the Password is introduced. Password protection for certain operator functions is provided for security. We do not preset passwords at the factory.

To set the password:

[Shift]+[Cntl.Parm] will produce PWEN/PSWD in the Process and Set displays. Press the sequence that you wish to use as the password then press [Enter]. Any combination of keys, up to nine strokes, except [Shift] or [Enter] can be used as the password.

To bypass the password if the old one is known:

Press [Cntl parm] press the old Password and then press [Enter] press the new password and press [Enter]. “See Setup and Configuration” for the location of the password.

To change an operating function when lock level = 1:

[Shift] [Alarm Set] [Cntl Parm] [Alarm Set]

To bypass the password there is none:

Press [Enter].

If you are locked out because you forgot the password, you will have to

Remove the front panel.

Find DIP switch 8 in the top bank. Turn it to ON.

Find the 4 switch (bottom) bank and set them all to OFF. This resets the address to 0.

Press [Shift],[Cntl Parm] and [Enter][Enter] to create "enter" as a new password. Return the bottom bank to its original address setting. Turn switch 8 in the top bank OFF. Replace the front

**panel. The new password is in effect. See “Setup and Configuration” for more details.**

# **SPECIFICATION**

# **S**

## **Alarm Outputs**

**Ambient  
Temperature  
Analog  
Outputs**

**Auxiliary Input  
Impedance  
Auxiliary Input  
Range  
Control  
Outputs**

**Serial Interface  
Host**

**Events**

**Slave**

**Dimensions**

**Humidity  
Line Voltage  
Panel Cutout  
Requirements**

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## **Programs**

**PID Constants**

**Proportional**

**Band**

**Reset**

**Rate**

**Cycle Time**

**Relays**

## **Setpoint**

**Signal Input**

**Impedance**

**Signal Input**

**Range**

**Signal Display**

**Range**

**Depends on**

**thermocouple**

**type**

**Thermocouple**

**E:**

**J:**

**K:**

**C:**

**R:**

**S:** Two solid state relay  
**T:** contacts for the  
process alarms -300 to  
4000. Programmer  
alarm provided by  
optional OPTOMUX  
interface.

**Weight**

0 to 130 F  
0 to 5 volts for 0-4000  
F  
0 to 5 volts for -99 to  
+99 control output

10K ohm  
0 to 2 Vdc  
Two solid state relay  
contacts selectable for  
Time-Proportioning or  
Position-Proportionin  
g.

RS-422, 1200 BAUD,  
Half Duplex MMI  
protocol and 10PRO  
emulation

RS-422, 1200  
BAUD, Full  
Duplex  
OPTOMUX  
protocol  
RS-422, 1200  
BAUD, Half  
Duplex BC-560  
broadcast

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**mode**  
**5.63 in. wide by**  
**5.63 in. high by**  
**8.38 in. deep**  
**0 to 85%**  
**85 to 140 VAC,**  
**50/60 Hz**  
**5.43 in. square**  
**200, 19 steps**  
**each**

**1 to 999% of**  
**Range**  
**0 to 99.99 RPM**  
**0 to 9.99**  
**minutes**  
**0 to 250**  
**seconds**  
**Solid state,**  
**triacs,**  
**Mechanical,**  
**dry contact, 1**  
**ampere, 125**  
**VAC maximum**  
**(fused at 1**  
**amp)**  
**-300 to 4000**  
**-999 to +999**  
**setpoint offset**  
**for receipt of**  
**master**  
**broadcast**  
**100K ohm**  
**-10 to +64 mV**  
  
**-300 to 4000**

(+4)

**Linear  
Chromel-Const  
antan  
Iron-Constanta  
n  
Chromel-Alum  
el  
Tungsten 5%  
Rhenium vs.  
Tungsten 26%  
Rhenium  
Platinum vs.  
Platinum 13%  
Rhodium  
Platinum vs.  
Platinum 10%  
Rhodium  
Copper-Consta  
ntan**

**Approximately  
11 pounds**

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## Glossary

### Load Line

Load line (LdLn) is a manual offset to the control output (manual reset). The load line can be set from 0 to 100%. Load line must be set to zero when using ON/OFF control.

### ON/OFF control

In ON/OFF control Output 1 is turned ON whenever the percent output exceeds 10% and Output 2 is turned ON whenever the percent output goes below -10%. Therefore the proportional band is used to set the deadband. If the proportional band is set at 5% then an error of 5 will produce a 10% output; therefore, the deadband is 5. Reset and Rate would normally be set to zero; however, experimentation could improve the control response. Load Line must be set to zero.

### Position with Feedback

**This mode is used with slidewire feedback. Output 1 is used to drive for more feedback and Output 2 is used to drive for a smaller feedback. The percent output is used as a setpoint for the slidewire feedback. A deadband of .5% is used to prevent hunting.**

#### **Position without Feedback**

**This mode is used with a motorized valve with no feedback. The change in percent output is used to compute a drive time as a percent of the cycle time. For example, if the cycle time is 30 seconds and the percent output changes from 40% to 60% then Output 1 will be ON for 6 seconds (20% of 30 seconds). If the change was in the opposite direction then Output 2 is turned ON. If the percent output is at its limits (0 or 100 for single, and 100 or -100 for dual) then the appropriate output will remain ON continuously.**

#### **Proportional Band**

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**The proportional band is based upon a range of 1000. Therefore, if the proportional band is set at 10% and the error is 100 (10% of range) then the output would be 100% (presuming reset=0).**

### **Rate**

**The rate setting is in minutes and is settable from 0 to 9.99 minutes in .01 steps.**

### **Reset**

**The reset setting is in repeats per minute. The range is 0 to 99.99 repeats per minute in .01 steps.**

### **Time Proportion**

**In time proportion mode Output 1 is ON for the percent of the cycle time when the percent output is plus. When the percent output is minus, Output 2 is ON for the percent of the cycle time.**

# Appendix A

## Hexadecimal Code

Hexadecimal code is a functional, compact method of representing certain parameters within the binary computer framework. Hexadecimal code uses four binary bits to make one hexadecimal digit.\* The number range for the hexadecimal system is 0 to F where the corresponding base numbers are as follows:

Decimal System	Binary System	Hexadecimal System
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

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To convert a binary number to the equivalent hexadecimal number, follow the procedure listed below:

1. Group the binary representation into sets of four.

i.e. 1100 1111 0011 1101

2. Analyze each set of four separately for the equivalent hexadecimal digit determined from the chart above.

i.e. 1100 1111 0011

1101

C F 3

D

\* For further explanation, consult any college digital systems text, such as Microcomputer-Based Design by John B. Peatman.

3. Put all of the separate HEX digits together to form the numerical word.

i.e. CF3DH\*

4. Therefore, the HEX representation CF3DH is numerically equivalent to the Binary representation

01011100111100111101 or the Decimal number 53,053.

**Hexadecimal code is an extremely helpful number representation when coding computer systems. Recall that most addressing systems for microprocessors involve 16 binary bits which convert to four HEX digits and 8 binary data bits that convert to two HEX digits. The HEX system allows very long binary numbers to be represented in a much shorter way. Many of the responses to the MMI Controller's Serial Communications questions are in HEX. Therefore, in order for the user to correctly interpret an answer, a clear understanding of the Hexadecimal number system must be attained.**

**\* An H is written after hexadecimal numbers to signify that the number is hexadecimal, it is not part of the actual number value.**

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**Version 3.5 UNIPRO setup sheet**

**Furnace #** \_\_\_\_\_

**[Ctrl Parm]**

**PB**

**RES**

**RAT**

**CYC**

**LOPO**

**HIPO**

**LDLN**

**[Alarm set]**

**A1\_\_**

**A1XX**

**A2\_\_**

**A2xx**

**TON1**

**TOF1**

**TON2**

**TOF2**

**[Setpt]**

**STPT**

**REF**

**TCO**

**[Shift\Alarmset]**

**AO1**

**AO2**

**AO1O**

**AO1R**

**AO2O**

**AO2R**

**AI A**

**AI B**

**AI C**

**CONV**

**COMD**

**HOST**

**AUX**

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**UNIT #3**

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**UNIT #4**

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**EALF  
EALF**

**DIP switch  
settings  
circle ON**

**UNIT #1**

**UNIT #2**

**UNIT #3**

**UNIT #4**

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**BANK 1**  
**BANK 2**

**BANK 1**  
**BANK 2**

**BANK 1**  
**BANK 2**

**BANK 1**  
**BANK 2**

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**1 2 3 4  
1 2 3 4**

**1 2 3 4  
1 2 3 4**

**1 2 3 4  
1 2 3 4**

**1 2 3 4  
1 2 3 4**

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**5 6 7 8**

**5 6 7 8**

**5 6 7 8**

**5 6 7 8**

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