900 EPC

SERIES

EUROTHERM CONTROLS

Handbook supplement

900 EPC
Handbook supplement

Contents

Chapter 1 INTRODUCTION

This supplement provides information about the key new features introduced to the 900 EPC at release 4.12 and release 5.11. It is also applicable to the Controller 'Plus' instruments (release 2.50). For information about the main features of the 900 EPC range please refer to the 900 EPC Series Enhanced Programmer Controllers Handbook (HA021482) which will also have been shipped to you with your instrument.

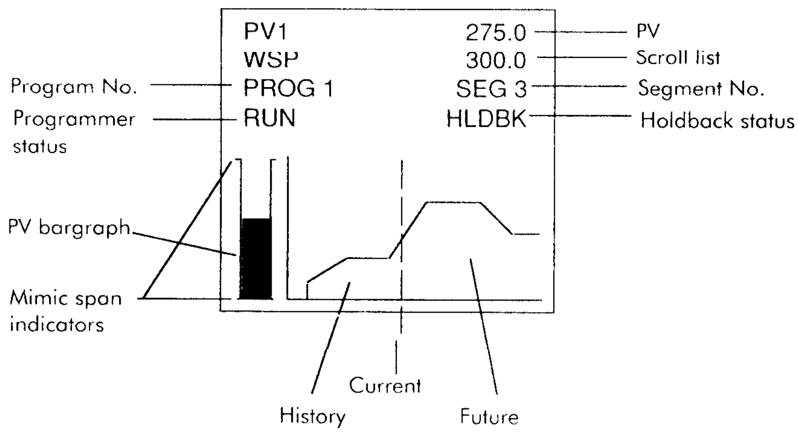
To make the instrument simpler to use the 900 EPC is now being shipped with many parameters in the scroll list hidden from view. The tuning page and some of the programmer pages at level 1 have also been hidden. To make these parameters/pages available again please refer to the Allocations sub-section of the Commissioning section (pages 14 to 24) of the main Handbook. The instrument is also being shipped with alarms configured for 'de-energised in alarm' whereas previously they were configured for 'energised in alarm'. Further information on alarms is to be found in the Operation section (pages 33 to 36) of the main Handbook.

The 900 EPC instruments are capable of solving very complex control problems using their many features. To allow solutions to be reproduced when required, it is essential that all configurations be logged, especially those involving User Wiring or Programmable Logic.

Chapter 2 PROGRAMMER MIMIC

- **Graphical Representation of Program Execution**
- **PV, Setpoint, Programmer Control & Status all on one page**

The programmer mimic page was introduced into the 900 EPC with the release 5.11. This page is found in the level 1 pages and under RUNNING DATA at levels 2 and 3. It can be hidden using the normal UI security system. The page consists of the mimic, a scroll list, the PV, a bargraph and some basic programmer status data.



Programmer Mimic Page

The dotted vertical line on the mimic represents the current execution position of the programmer. Everything to the right of this line represents the future setpoint profile while everything to the left represents the recent historical value of setpoint. Calls to subprograms and multiple cycles of programs and subprograms will be expanded out and shown as future segments.

The scroll list consists of the following parameters :

WSP	:	Working Setpoint	
OP	:	Output	
TM	:	Time Remaining in current segment	
SEG	:	Current Segment number	
RAT	:	Ramp Rate	
TGT	:	Target Segment	
PSP	:	Programmer Setpoint	
SSG	:	Current Subprogram Segment number	
RUN?	:	Pressing view key will RUN loaded programs	Pressing the up/down
RESET?	:	Pressing view key will RESET the programmer	keys will change
HOLD?	:	Pressing view key will HOLD the programmer	the selection

The scroll list does not time out and parameters cannot be hidden. Parameters are, however, context sensitive. For example, in a dwell segment the ramp rate RAT will not appear. If the scroll list is on RAT when a dwell is entered, RAT will show a blank until it is relevant again.

In HOLD the scroll list provides all the current segment data that can be changed. Changes to the current segment are reflected on the mimic and will be actioned when the programmer is returned to the RUN state. Currently, it is not possible to make permanent changes to the loaded program while in HOLD.

When no program is loaded the mimic is blank. Once a program is loaded the mimic will show the program that will be executed when the programmer is put into RUN. In this RESET state the history side of the mimic shows the current working setpoint. As the program is executed, the segments scroll from right to left, future segments becoming current then historical. Should the power to the instrument fail then the history is lost and POWER FAIL displayed in its place.

The mimic graph is to scale on the vertical axis, the mimic span being configurable as a percentage of the instrument span. The section of the instrument span covered by the mimic is shown by two indicators on the PV bargraph. The mimic will always try and keep the current setpoint in the centre of the mimic. For a mimic span of less than 100% this will result in vertical scrolling of the mimic view which will be shown by the indicators. The horizontal axis is not to scale. Instead it is divided into segments, the boundaries being marked by breaks in the axis. The mimic span can be changed under PROGRAMS I GENERAL I MIMIC DETAILS.

In FASTRUN the mimic can be used to step through the program. It should be remembered that the program setpoint is not changed by stepping through segments and so the history will look like a dwell. Stepping through two or more segments will cause the history to be lost completely; this is shown by a dotted line.

Chapter 3 PROGRAMMABLE LOGIC

Introduction

The 900 EPC provides Programmable Logic Registers that allow combinations of digital values within the instrument. Amongst other things these Registers can define complex switching conditions, allow actions only on the combination of multiple conditions, provide more flexible control of the programmer,allow a single digital input to perform multiple functions, or link alarms to enable secondary functions internally without the need for external wiring.

Inputs

The inputs to the Programmable Logic Registers are:

PRG DG 1-12	Programmer Digital Outputs 1 to 12
PRG RUN	ON when programmer is running
PRG HOLD	ON when programmer is in HOLD
PRG RESET	ON when programmer is RESET
PRG CMPLT	ON when programmer ends and before programmer is RESET
HOLDBACK	ON when programmer is in HOLDBACK
LOG HOLD	ON if programmer has been in HOLD, OFF after programmer RESET
LOG HLDBK	ON if programmer has BEEN in HOLDBACK, OFF after RESET
REGISTER 1-12	Programmable Logic Registers 1 to 12
SWITCH 1-4	Switches for Programmable Logic 1 to 4
TLSR OP 1-4	Totaliser 1 to 4 Alarm Outputs
ANY TLSR	ON if any totaliser alarm is active
DFLT VL 1-8	ON if the corresponding Calculated Value is in default status
ANY DFLT	ON if any Calculated Value is in default status
PV1 BRK	ON if Process Input 1 is in sensor break
PV2 BRK	ON if Process Input 2 is in sensor break
REM 1 BRK	ON if Loop 1 Remote Input is in sensor break
REM 2 BRK	ON if Loop 2 Remote Input is in sensor break
VP 1 BRK	ON if Loop 1 Valve Position Input is in sensor break
VP 2 BRK	ON if Loop 2 Valve Position Input is in sensor break
ALM OP 1-4	ON if corresponding alarm is Active
ANY ALM	ON if any alarm is Active
A-M LP1, LP2	ON if corresponding loop is in Manual mode
REM LP1, LP2	ON if Remote Function Active
SRL LP1, LP2	ON if Setpoint Rate Limit Active
ORL LP1, LP2	ON if Output Rate Limit Active
SP2 LP1, LP2	ON if Setpoint 2 Active
AT LP1, LP2	ON if Auto Tune is active
ADT LP1, LP2	ON if Adaptive Tune is active

RAT STAT	ON if instrument is in Ratio Mode
RA2 STAT	ON if Ratio Setpoint 2 is active in Ratio Mode
CSCD STAT	ON if instrument is in Cascade Mode
DIG IP 1, 2	ON if corresponding micro board digital input is active
SLT 1-6 IP 1-4	ON if input from module in slot is active
TIMER1-4ACT	ON if Timer 1 to 4 is actioning
TIMER1-4TRG	ON if ON/OFF delay 1-4 is triggered
NONE	Input not used - usually the second input

Operators

The operators available to combine the inputs to a Programmable Logic Register are:

NONE	When used the Register takes the value of the first input.
AND	Register is ON only if both inputs are ON and OFF if either are OFF
OR	Register is ON if either input is ON and OFF if both are OFF
XOR	Register is ON if one and only one input is ON and OFF if both are ON or both are OFF
LATCH	Register is ON if input 1 is or has been ON since input 2 was last ON. The LATCH operator latches input 1 in the register and is reset by input 2. (This is a phase 5 feature.) Note : a latch can easily be created and is one of the examples below.

Both the inputs to a Programable Logic Register value can be inverted by scrolling to the apparently blank field on the configuration screen and using the RAISE key to change it to NOT. One use for this is to change the sense of an input - closed is normally active which suits relays but open or high volts is the normal active state of a logic output which can be accomodated by adding the NOT. Another use is to build the missing logic operators NOR and NAND familiar from digital electronics. NOR is equivalent to AND with both inputs inverted and NAND is equivalent to OR with both inputs inverted.

Outputs

The functions to which Programmable Logic Registers can be wired are:

AUTO MAN LP1, LP2, 1&2	Loop(s) in Manual Mode if Register ON For this to work: Manual Mode or Forced Output must be configured This will put a running program on this loop into HOLD.
REM ENABL LP1, LP2, 1&2	Remote function(s) for loop(s) active if Register ON Remote functions can only be enabled if: Auto tune is not active

A remote input is fitted for the loop and has been configured with remote function remote setpoint, remote setpoint trim, remote powerlimit or ratio setpoint trim or a calculated value has been configured to one of these functions.

SP2 ENABL LP1, LP2, 1&2	Setpoint 2 active if Register ON Setpoint 2 will not become active if: A program is running A digital input is forcing setpoint 1 A Remote Setpoint is active Ratio mode is active Cascade mode is active - loop 2 only A calculated value is wired to working setpoint Auto Tune is running If the Register is ON Setpoint 2 will become the working setpoint when other influences are gone. If Setpoint Rate Limit is active the working setpoint will move to Setpoint 2 at the limited rate.
SP RATLIM LP1, LP2, 1&2	Setpoint Rate Limit active if Register ON Setpoint Rate Limit will not become active if not configured or if Auto Tune is active
FRZ INTEG LP1, LP2, 1&2	Integral frozen at current value when Register ON There are no restrictions on the use on Freeze Integral. It is used to preserve the output prior to a predictable disturbance to ensure quick recovery.
OP RATLIM LP1, LP2, 1&2	Output Rate Limit active if Register ON Output Rate Limit will not become active if it is not configured or if Auto tune is active.
AUTO TUNE LP1, LP2, 1&2	Auto Tune started as Register comes ON Auto tune is not possible if: Autotune is not configured Setpoint or Output rate limits are active This is the Cascade Master Loop and Cascade Mode is disabled. This is the Cascade Slave Loop and Cascade Mode is enabled Setpoint 2 is active Remote status is active The Programmer is not RESET Ratio Mode is active
ADAP TUNE LP1, LP2, 1&2	Adaptive Tune is active if Register is ON Adaptive Tune must be configured to Continuous Adaptive Tune for this to work.

GAIN SCHE LP1, LP2, 1&2	Gain Scheduling is active if Register is ON Adaptive Tune must be configured to a Gain Scheduling type for this to work.
RATIO ENABLE	Ratio Mode is active if Register is ON This only works for Ratio Instrument types.
RAT SP2 ENAB	Ratio Setpoint 2 is used in Ratio Mode if Register is ON This only works for Ratio Instrument types.
KEYLOCK ENABLE	Front panel keys are disabled if Register is ON
SELECT IP 2	Select Input Instruments only - use Input 2 if Register is ON
DIG COMMS DIS	Digital Communications disabled if Register is ON
DIG RETRA DIS	Not yet available
BROADCAST DIS	Not yet available
STANDBY ENABL	Instrument enters Standby Mode if Register is ON For this to work Standby Mode must be configured.
TIMER 1-4	EnableTimers if Register is ON
TIMER DISABL	Disable Daily Scheduler when Register is ON
SP1LOOP 1,LOOP 2,LPS 1&2	Use Setpoint 1 if Register is ON The switch to setpoint 1 will not occur if: A Digital Input or lower Register is forcing Remote Setpoint or Setpoint 2 The Programmer is not reset Cascade Mode is acitve - Loop 2 Ratio Mode is active - Loop 1
ALARM ACK	Acknowledge all Active Alarms if Register is ON
TELEMETRY	Not used
RESET TLSR 1-4	Reset corresponding Totaliser if Register is ON
RST ALL TLSR	Reset all Totalisers if Register is ON
RUN	Run loaded program(s) when Register is ON This will work if : No other Register or Digital Input is forcing HOLD or RESET A programme is loaded on at least one loop Loops with loaded programmes are neither in manual nor are performing autotune. If the Register stays ON after the program runs then it will run again
HOLD	Hold programmer if running or reset if Register is ON
RESET	Reset programmer if Register is ON
RUN HOLD	Run loaded program(s) when ON, hold when OFF See RUN above for limitations
HOLD RUN	Hold program when ON, run program(s) when OFF
HOLDBACK DIS	Stop Holdback from operating when Register is ON
LP1, LP2, 1&2 SKIP SEG	OFF to ON transition advances runnng or in HOLD program to the start of the next segment for one or both loops.

LP1, LP2, 1&2 WAIT UNTIL	Causes the program loop to wait at the end of the current segment until the Register is OFF for one or both loops.
LOAD PROG LP1, LP2, 1&2	Load the selected program to the corresponding loop
LP1, LP2, 1&2 LSD PRGNO	If ON adds 1 to program number, if OFF adds 0
LP1, LP2, 1&2 2LSD PGNO	If ON adds 2 to program number, if OFF adds 0
LP1, LP2, 1&2 3LSD PGNO	If ON adds 4 to program number, if OFF adds 0
LP1, LP2, 1&2 MSD PGNO	If ON adds 8 to program number, if OFF adds 0
LP1, LP2, BTH BCD1 PGNO	If ON adds 1 to units digit of program number, if OFF adds 0
LP1, LP2, BTH BCD2 PGNO	If ON adds 2 to units digit of program number, if OFF adds 0
LP1, LP2, BTH BCD3 PGNO	If ON adds 4 to units digit of program number, if OFF adds 0
LP1, LP2, BTH BCD4 PGNO	If ON adds 8 to units digit of program number, if OFF adds 0
LP1, LP2, BTH BCD5 PGNO	If ON adds 1 to tens digit of program number, if OFF adds 0
LP1, LP2, BTH BCD6 PGNO	If ON adds 2 to tens digit of program number, if OFF adds 0
LP1, LP2, BTH BCD7 PGNO	If ON adds 4 to tens digit of program number, if OFF adds 0
LP1, LP2, BTH BCD8 PGNO	If ON adds 4 to tens digit of programnumber, if OFF adds 0
LP1, LP2, 1&2 LSD SCHD	If ON adds 1 to number of gain scheduling set, if OFF adds 0
LP1, LP2, 1&2 2LSD SCHD	If ON adds 2 to number of gain scheduling set, if OFF adds 0
LP1, LP2, 1&2 MSD SCHD	If ON adds 4 to number of gain scheduling set, if OFF adds 0

Note. Digital/Registers win over the instrument front panel and digital comms when active but don't care if inactive

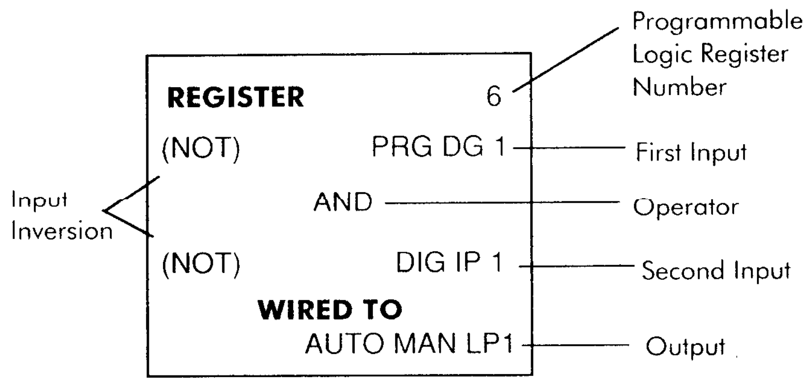
Programmable Logic Availability

Every programmer instrument type has Programmable Logic available, although it must be configured explicitly in the menu USER CONFIG I USER WIRING I AVAILABILITY. Change NO PROG LOGIC to PROG LOGIC to make it available. Programmable logic is also configurable on Controller PLUS instruments.

Setting up Programmable Logic

Programmable Logic is set up in configuration mode. Programmable Logic configuration is found under the USER CONFIG I USER WIRING I PROG LOGIC menu.

User wiring is found towards the end of the list under USER CONFIG so remember to press and hold the SCROLL key and dab the LOWER key to get there quickly. The PROG LOGIC set up page looks like this:



Programmable Logic Wiring Screen

To configure the Programmable Logic first select the number of the Register to be programmed. Next choose the first input and set NOT if it is to be inverted. Choose the operator to combine the two inputs. Now choose the second input and inversion. Finally select the output if any from the Register. It is valid to have NONE for operator, second input and output. An example of such a configuration is when using Programmable Logic to transfer a Programmer Digital Output to a select on Register operator in the User Wiring of Calculated Values.

Viewing the Programmable Logic Registers

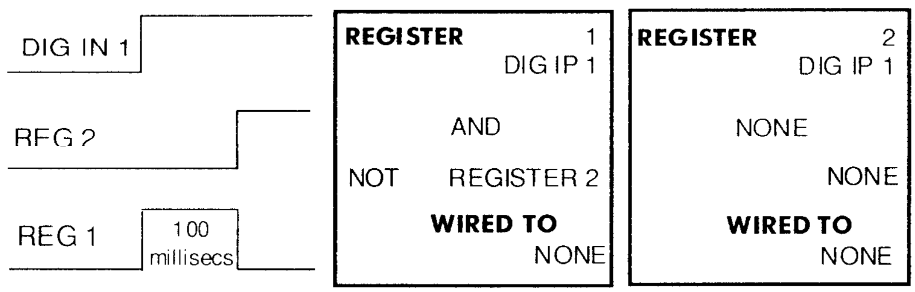
The USER WIRING | PROG LOGIC screens, which are available at levels 2 and 3, provide access to the Programmable Logic Registers during normal operation. The DIAGNOSTICS screen shows the twelve Registers in the familiar piano keys style where a filled upper box indicates that the Register is ON.
The SWITCHES screen provides access to change the four Switches. Alternatively the switches can be altered in the scroll list where they appear with the text SW1 to SW4 or they can be placed on any of the five User Defined Screens.

The Output of Programmable Logic Registers

It is possible to send any of the Programmable Logic Registers out through any of the ON-OFF type output modules: i.e. the single, dual, triple and quad logic outputs, the single and dual relay outputs and the dual triac module. Configure the outputs under INSTR CONFIG | SLT FUNCTION where the appropriate functions are REGISTER 1 to REGISTER 12.

Hints and Tricks Using Programmable Logic

When designing with programmable logic it is often helpful to use the order of evaluation of the Registers. Register 1 is calculated first and its new value is available when Register 2 is calculated. When Register 1 is calculated however, Register 12 contains its old value so by choosing Registers carefully a beneficial combination of new and old values can be used. An example of this technique is the conversion of an incoming edge to a single 100 millisecond pulse (100 milliseconds is the update rate of the Programmable Logic).



Using two Registers to Convert an incoming Edge to a Pulse

This configuration works as follows:

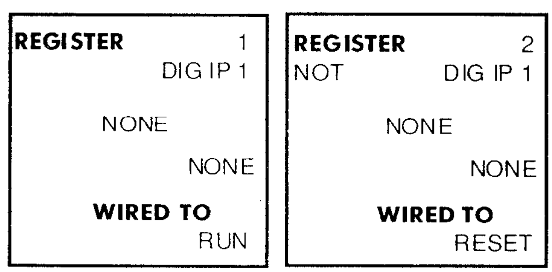
When the digital input is OFF Register 1 (the output) is OFF due to the AND operator. When the digital input comes ON Register 1 comes ON as Register 2 is OFF so NOT Register 2 is ON. After Register 1 comes on Register 2 comes ON.

100 milliseconds later Register 1 goes OFF as Register 2 is now ON and NOT Register 2 is OFF.

Examples

Run-Reset Digital Input for the Programmer

It is sometimes necessary to have a single digital input which when active causes a program to run and which resets the program when the digital input is inactive. This is often required when the 900 EPC is being used to replace an 822. A configuration of two Registers is shown to perform this function. Note that a RUN-RESET input is now standard with the programmer software.



Using two Registers to RUN and RESET the Programmer release.

A Single Digital Input to Load and Run a Program

This example shows the use of a single digital input to load a program and then to run it. The most likely use of this configuration is with a binary switch (or BCD switch with the software release 5.11) to select the programmer with digital inputs and where all programs have been tested and end with the RESET PROGRAMMER end type.

REGISTER 1	REGISTER 2
DIG IP 1	DIG IP 1
NONE	NONE
NONE	NONE
WIRED TO	**WIRED TO**
LOAD PROG LP1	RUN

Using two Registers to LOAD and RUN a Program

Using a Single Digital Input to Run a Program and Control Wait Until when Running

Sometimes in complex applications all the module slots in the 900 EPC can become full leaving no space for digital inputs to perform program control. This example shows the combination of a digital input with programmer digital outputs and programmer status information to perform two different functions depending on the state of the instrument. If the programmer is RESET then the digital input runs the loaded program, if the program is running the digital input is used to advance the program past WAIT UNTIL points when the operator is ready.
WAIT UNTIL is only to operate in some segments - if Programmer Digital Output 1 is set ON in a segment then the programmer will wait at the end of that segment until the operator presses a button connected to Digital Input 1.

REGISTER 1	REGISTER 2
PRG DG 1	DIG IP 1
AND	AND
NOT DIG IP 1	PROG RESET
WIRED TO	**WIRED TO**
LP1 WAIT UNTIL	RUN

Using two Registers to RUN and Control Wait Until

Holdback only in Some Segments

In many applications Holdback in only needed in the Dwell segments of a program. With the 900 EPC Holdback can only be set on a per program basis. It is possible to use the Programmer Digital Outputs to turn on Holdback in only some segments. This example shows how. Holdback will only be active if Programmer Digital Output 1 in ON.

REGISTER 1
NOT PRG DG 1
NONE
NONE
WIRED TO
HOLDBACK DIS

Using a Register to Control Holdback

Step Program Number

This is a more complex example that shows how a number of the Registers can be used in conjunction to perform a more complicated operation. The example here is to use a single digital input to step the program number as you can with the 818.

REGISTER 1 DIG IP 1 AND NOT REGISTER 2 **WIRED TO** NONE	**REGISTER** 2 DIG IP 1 NONE NONE **WIRED TO** NONE	**REGISTER** 3 REGISTER 1 AND REGISTER 6 **WIRED TO** NONE
REGISTER 4 REGISTER 3 AND REGISTER 7 **WIRED TO** NONE	**REGISTER** 5 REGISTER 4 AND REGISTER 8 **WIRED TO** NONE	**REGISTER** 6 REGISTER 1 XOR REGISTER 6 **WIRED TO** LP1 LSD PRGNO
REGISTER 7 REGISTER 7 XOR REGISTER 3 **WIRED TO** LP1 2LSD PRGNO	**REGISTER** 8 REGISTER 8 XOR REGISTER 4 **WIRED TO** LP1 3LSD PRGNO	**REGISTER** 9 REGISTER 9 XOR REGISTER 5 **WIRED TO** LP1 MSD PRGNO

Programmable Logic to Select Program Number on Pulses from a Digital Input

The first two Registers convert the incoming edge into a pulse as described above. To understand the operation of the rest, consider the table below which shows the state of the two least significant bits of the program number before and after an OFF to ON edge at the input:

OLD 2LSD	OLD LSD	INPUT	NEW2 LSD	NEW LSD
OFF OFF	OFF OFF	OFF ON	OFF OFF	OFF ON
OFF OFF	ON ON	OFF ON	OFF ON	ON OFF
ON ON	OFF OFF	OFF ON	ON ON	OFF ON
ON ON	ON ON	OFF ON	ON OFF	ON OFF

The table shows how if the input is OFF then the new program number (NEW 2LSD, NEW LSD) is the same as the old but if the input in ON then the new program number is the next in the binary sequence 00,01,10,11.00.... The edge to pulse conversion mentioned above is needed to stop the program number racing through the whole sequence. To understand the operation first look at the relationship between NEW LSD and OLD LSD, which is recognisable as the XOR truth table. Register 6 contains this calculation to generate the NEW LSD from the OLD LSD. Now look at the table for NEW 2LSD. This resembles the XOR truth table but needs an additional qualifier coming from OLD LSD AND INPUT. So the expression for NEW 2LSD is:

NEW 2LSD = OLD 2LSD XOR (INPUT AND OLD LSD)

Registers 3 and 7 perform this calculation. Note that it is important that INPUT AND OLD LSD be performed before Register 6 is updated to NEW LSD. It is for this reason that all the AND operations are in lower numbered Registers than the XORs.

Apply similar reasoning to get expressions for the other digits:

NEW 3LSD = OLD 3LSD XOR ((INPUT AND OLD LSD) AND OLD 2LSD)
NEW MSD = OLD MSD XOR (((INPUT AND OLD LSD) AND OLD 2LSD) AND OLD 3LSD)

Registers 3 to 9 perform the entire calculation.

Chapter 4 USER WIRING OF CALCULATED VALUES

Introduction

The 900 EPC allows the user wiring of calculated values. These calculated values allow the 900 EPC user to:

- Perform special input conditioning
- Design special control strategies by cascading the two PID loops in novel ways
- Modify the instrument outputs possibly using a combination of analogue and digital outputs
- Design special machine controllers contributing calculated values with totalisers and programmable logic

Some worked examples are given below.

Definitions

Calculated Value - a value within the instrument caculated from two other values. Setting up and using these calculated values is the subject of this chapter. There are 8 calculated values which are often referred to as CV1 to CV8 as they appear on the scroll list. The wiring of the calculated values is set up in configuration mode.

User Value a number that the user of the 900 EPC can change which is used as input to calculated values. The four user values are often known as UV1 to UV4.

Programmable Logic - a similar technique to calculated values but compiling ON/OFF data rather than numerical values.

Programmable Logic Register - the storage location where combinations of ON/OFF data are performed and saved. Often calculated values use these registers to select between two values.

Totaliser - a value within the instrument which totalises or accumulates its input.

Limits and Default Values

Each calculated and user value has an upper and lower limit. For the user values the limits restrict the range of numbers to which the user value can be set. It is possible to make the upper and lower limit the same to force the user value to take a given value. For calculated values the limits are applied to the value after calculation. If the result of the calculation is outside the limits then the calculated value is forced to take a default value. The default value is set during calculated value configuration.

Each input to a calculated value brings with it both a value and a status. For example each process input might provide a temperature value but also whether the input is in sensor break or not. An input in sensor break or a calculated value in its default state is considered to be 'bad'. The operators used in evaluating the calculated values all have a strategy for deciding whether the calculated value should go to a default value if one or both inputs are bad. For example if either input to the ADD operator is bad then the default value is used but the SELECT MAX operator will use the only good input and not go to the default value if only one input is bad.

If any calculated value is in its default state then the alarm message CSB (Calculated Sensor Break) will be displayed on the operating display pages. Pages are available at levels 2 and 3 to indicate which calculated values are in the default state.

Inputs

The inputs to the calculated values are:

PV1, PV2	Process variable for loops 1 and 2 (See Figure 1).
LV1, LV2	Linearised values from the two instrument process inputs. (See Figure 1 for the relationship between PV and LV)
RV1, RV2	Values from up to two remote inputs
OP1, OP2	PID output for loop 1 and 2
SP1, SP2	Working setpoint loop 1 and 2
PSP1, PSP2	Programmer setpoint for loop 1 and 2
VP1, VP2	Valve position for loop 1 and 2
ERR1, ERR2	Error, PV - SP for loop 1 and 2
CV1 - CV8	Calculated values 1 to 8
UV1 - UV4	User values 1 to 4
TLSR1 - TLSR4	Totalisers 1 to 4
H01 1, H01 2	Channel 1 output upper limit for loops 1 and 2
L01 1, L01 2	Channel 1 output lower limit for loops 1 and 2 if the output configuration for the loop is PID channel 1 only.
H02 1, H02 2	Channel 2 output limit for loops 1 and 2 if the output configuration is PID channel 1 and 2

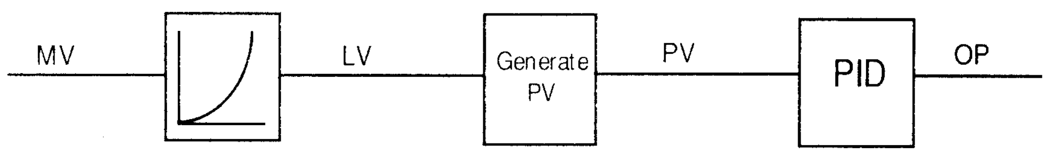


Figure. 1 The Relationship between LV and PV

Key:
MV: Measured Value in Volts, Ohms or Milliamps.
LV: Linearised Value in engineering units: °C, °F, %, etc.
Generate PV: User Wiring, Relative Humidity, Switchover, etc.

Operators

The operators available for calculated values are:

ADD
SUBTRACT
MULTIPLY
DIVIDE
ABS DIFF Absolute Difference

For the five operators above if either input is bad then the calculated value will adopt its default setting.

SEL MAX	Select Maximum
SEL MIN	Select Minimum
SWITCH TO	This is used to transfer smoothly between a thermocouple and a pyrometer as temperature increases. A proportion of both inputs is used in the switch over zone defined by the display range of the two inputs.

For these three operators if one of the inputs is bad then the calculated value will adopt the value of the other input. Only if both inputs are bad or the limits are reached will the calculated value adopt its default value.

SEL REG 1	Select On Programmable Logic Register 1
...	...
...	...
...	...
SEL REG 12	Select On Programmable Logic Register 12

A calculated value using a select on register operator will take the value of its first input if the value of the register is ON or TRUE and the second input otherwise. The calculated value will adopt its default if the selected input is bad irrespective of the state of the other input.

NONE	This is a valid operator if a calculated value is to be used to pass a value from one place to another, for example to make the working setpoint of loop 2 the same as the working setpoint of loop 1. It is also the only operator that ignores the sensor break state of its inputs so can be used to block the passage of bad status information through a cascaded calculation.

Outputs

The outputs to which calculated values can be wired are:

PRCS VAR 1, PRCS VAR 2	Process Variable for loop 1 or 2
REM SP 1, REM SP 2	Remote Setpoint for loops 1 or 2. This setpoint can be enabled with the local/remote switch on the scroll list.
WRKG SP 1, WRKG SP 2	Working Setpoint for loops 1 or 2. This setpoint overrules setpoint 1, setpoint 2 and any other remote setpoint so if a second setpoint is required it must be built into the user wiring.
REM LIM 1, REM LIM 2	Remote Channel 1 Power Limit for loops 1 or 2. This function is switched with the local/ remote switch on the scroll list.

REM LLV 1, REM LLV 2	Remote Channel 1 Power Limit and Power Level in manual. This function is switched with the local/remote switch on the scroll list.
LOW LIM 1, LOW LIM 2	Remote Low Power Limit for loops 1 and 2. If the control definition is 'PID Channel 1 Only ' then this is a lower limit in the channel 1 output power. If the control definition is 'PID Channel 1 and 2' then this is a channel 2 power limit. This function is switched with the local/ remote switch on the scroll list.
FEEDFWD 1, FEEDFWD 2	Feedforward for loop 1 and loop 2 that is added to the PID output before output limits and rate limits are applied.
PB1, PB2	Proportional Band for loop 1 and loop 2.
TI1, TI2	Integral time for loop 1 and loop 2.
OP1, OP2	Output for loop 1 and loop 2. This wiring only functions when the loop is in manual mode.
SP1, LP1, SP1, LP2	Setpoint 1 for loop 1 and loop 2. If this output is selected then SP1 in the scroll list is no longer changeable.
NOTHING	Used when values are being cascaded into further calculations or used for DC retransmission.

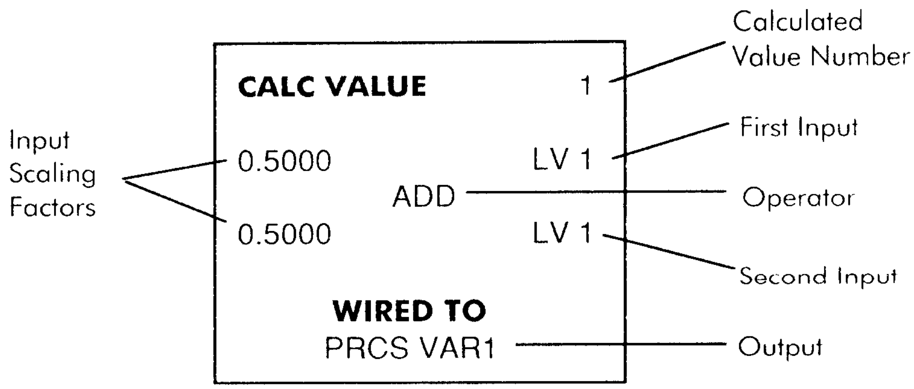
Instrument Types

User wiring of calculated values is now available on all instrument types. It is necessary to make calculated values available under USER CONFIG then USER WIRING then AVAILABILITY. Change NO CALC VALUES to CALC VALUES. Note that this is only possible if the instrument has been ordered from Eurotherm Controls with the PLUS option.

Setting up the User Wiring of Calculated Values

User wiring is set up in configuration mode. It is necessary to select one of the user wired instrument types under INST CONFIG then INST TYPE before going to the user wiring pages. Calculated value configuration is found under USER CONFIG then USER WIRING then CALC VALUES, where the choices WIRING, LIMITS and USER VALUES are offered.

The WIRING page where the mathematical operations are set up is shown below:



Calculated Value Wiring Screen

To configure the calculated values first set up the number of the calculated value to be configured. Next choose the first input and set up its scaling factor. Select the operator to combine the two inputs. Now choose the second input and a scaling factor for it. Finally select the output if any from the calculated value. It is valid to have an operator of NONE and a second input of NONE if the calculated value is only required to pass on a value, perhaps to force the working setpoint of loop 2 to follow the working setpoint of loop 1. It is also valid to wire the output to NOTHING.

The LIMITS page is where the upper and lower limits for the calculated values are entered and where the displayed resolution and default value are set up. As the instrument is only able to display numbers with five significant figures choosing three decimal places of resolution clips the upper and lower limits to 99.999.

The USER VALUES page is where the limits and resolution of the four user values are entered.

Viewing the Calculated Values

There are three ways to see the results of calculated value wiring. First any calculated or user value in use will appear in the scroll list for loop 1 and loop 2. Second calculated and user values can be programmed to appear on any of the five user defined display pages. Third display pages are provided at levels 2 and 3 to view the calculated values and change the user values.

If the first input to any calculated value is set to anything other than NONE then that calculated value is considered to be in use and the instrument puts it onto the scroll list for both loops. Calculated value 1 will have the title CV1 and so on for all the calculated values. It is not possible to change the value of a calculated value using the raise and lower keys. If any calculated value or Totaliser uses any of the user values as inputs then the user value will be placed on the scroll list with the title UV1 and so on. The user value can be changed within its limits in the normal way using the raise and lower keys. It is possible to remove any of these values from the scroll list or to change the access type for the user values from Read/Write to Read Only using the UI Security mechanism found under instrument operating level 3.

The calculated values and the user values all have unique communications mnemonics so they can be programmed to appear in the user defined display pages. The communications mnemonics are W1 to W8 for the eight calculated values and C1 to C4 for the four user values. If a user value is put on a user defined page then it will be changeable using the raise and lower keys. Full details on how to set up user defined pages can be found in chapter 5, page 26.

Access to the calculated and user values is also available at instrument operating levels 2 and 3 if the level 1 operator is to be denied access to the user wiring. Following the menus to USER WIRING then CALC VALUES will reveal a page offering CALC VAL 1-4, CALC VAL 5-8 and USER VAL 1-4. The first two options give a read only view of the eight calculated values and indicate their default status. The third option gives read and write access to the four user values.

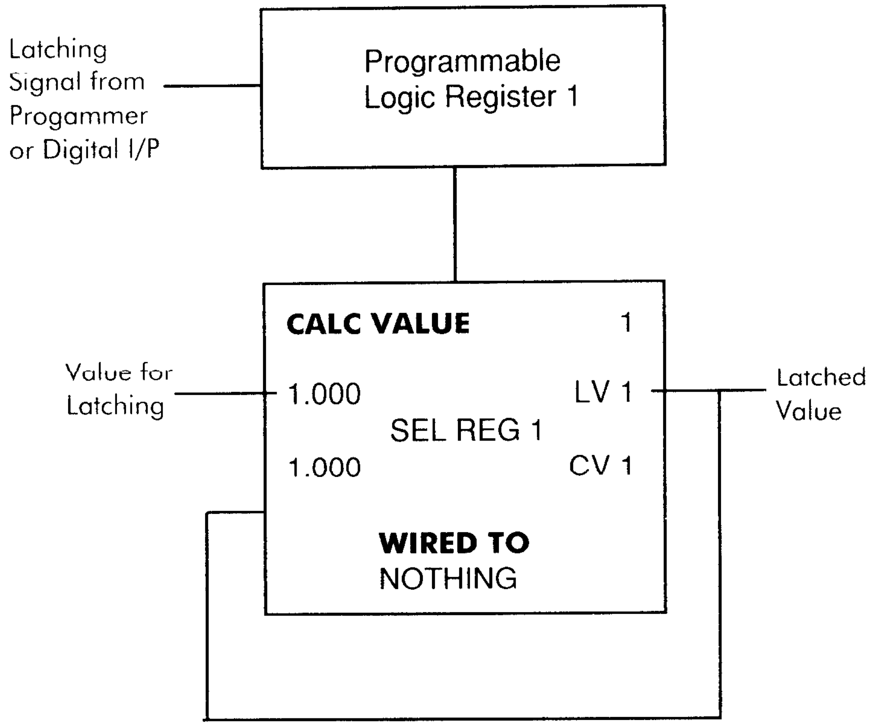
Retransmission of Calculated Values

It is possible to retransmit a calculated value using a DC Control or a DC Retransmission output module. To achieve this it is necessary to configure the slot function of the slot containing the DC output to CALC VALUE 1 (or any number to 8). The menu needed is INSTR CONFIG then SLT FUNCTION. It is also necessary to set up the output configuration and range. The menus are USER CONFIG then OUTPUT CONF then ANAL OP CONF where the output range in Volts or milliamps is set and ANAL OP RNG where the proportion of the display range of the calculated value for retransmission is defined.

Hints Regarding the Design of User Wired Systems

The calculated values are evaluated from CV1 to CV8 so if the result of one calculated value is to be used as the input to another it is better to do the first calculation with a lower numbered calculated value. This ensures that the complete calculation from CV1 to CV8 can complete within one 100 millisecond processing period.

One simple user wiring configuration that is often useful is a Sample and Hold Latch that catches and holds a value, as shown overleaf:



Calculated Value 1 used to Latch Input LV1

This latch could be enhanced by adding a second calculated value in the feedback path with the NONE operator to block the feedback and latching of default status. A similar configuration can also be used to catch the maximum or peak value on a signal if the select maximum operator is used instead of the select on programmable logic register operator.

Diagnosing problems when developing user wiring

The most useful place to examine the operation of the calculated values is at level 3 on the CALC VALUES page, where all eight values are displayed with default status. A further advantage of working at level 3 is that the User Values are readily accessible, the state of the Registers can be seen quickly and Read Config to check the wiring is not far away.

User Values

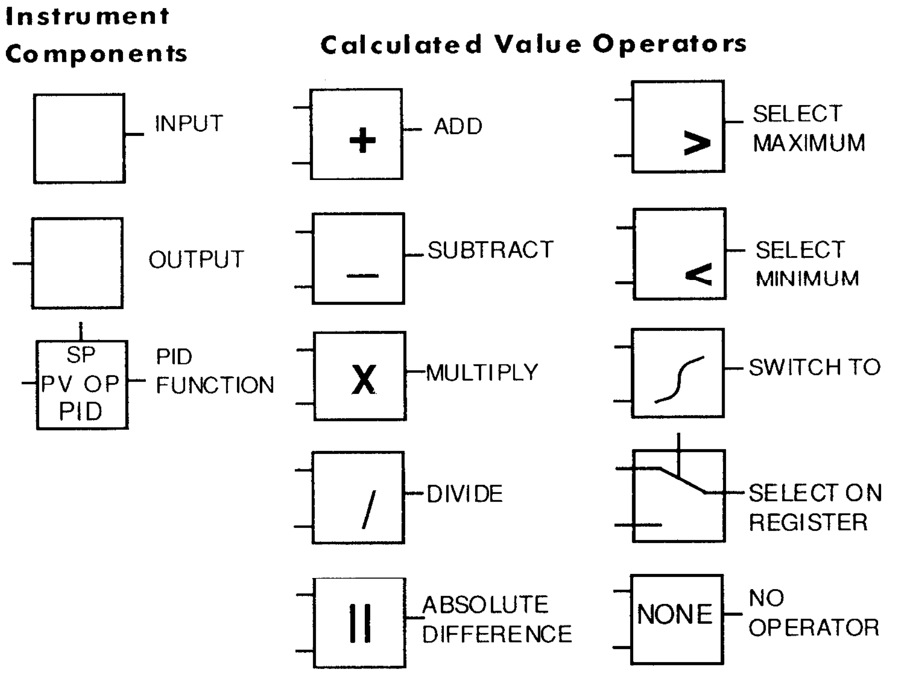
The user values can be forced to a single value by making the upper and lower limits the same.

It is possible to have more than four constants by using a set of different scaling factors on a single value. In the last example below scaling factors of 0.0, 0.2, 0.4 and 0.6 could be used with one value set to 100.0

Examples

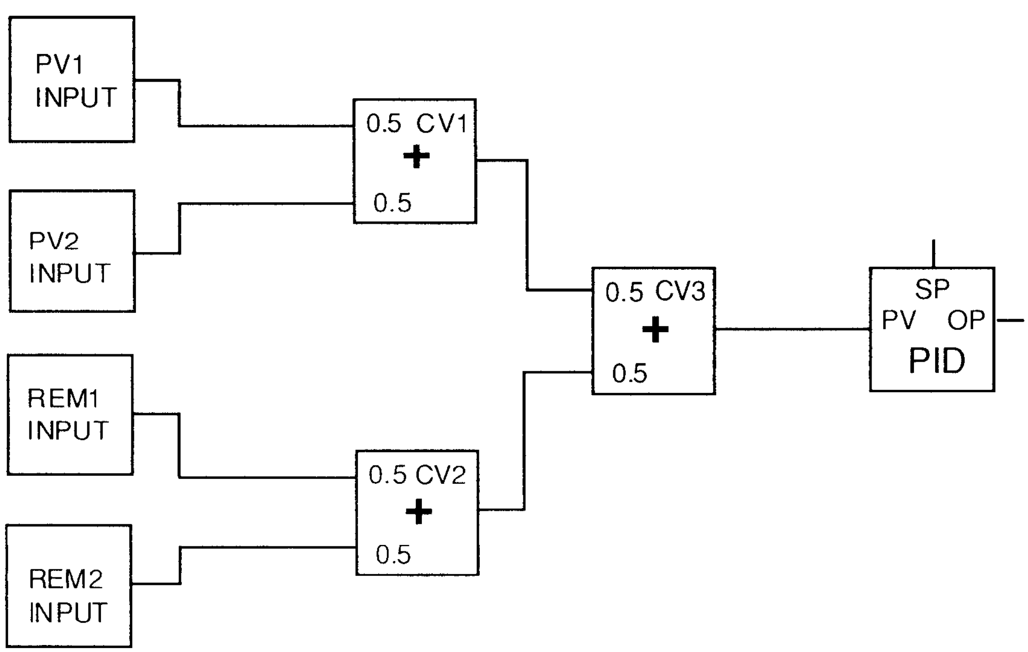
Introduction to the notation in the examples

Solid lines represent the flow of analogue values and dashed lines are digital quantities such as alarms and programmer digital outputs: .



Four Inputs averaged and used as PV for Loop 1

This is a simple example which shows how the scaling factors might be used and that calculated values can be cascaded.



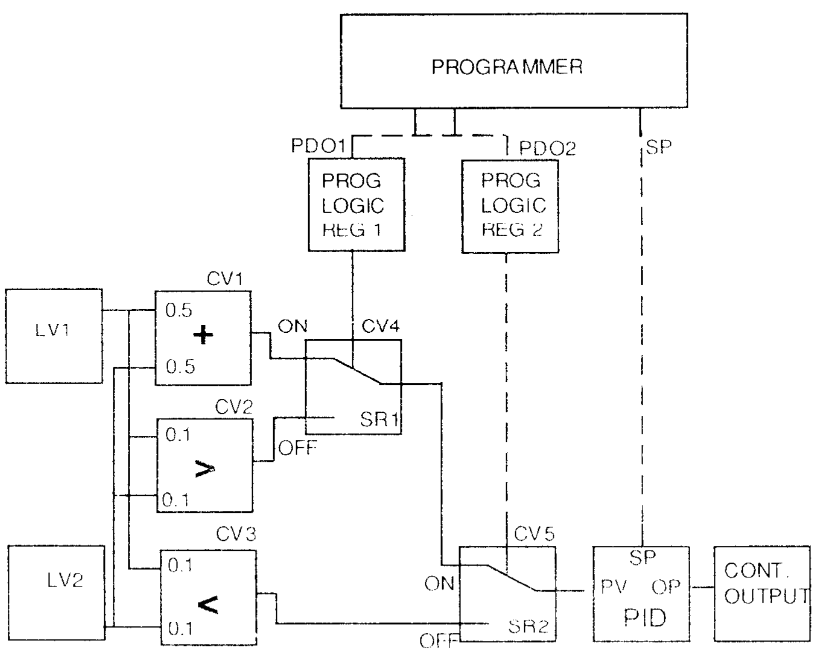
The wiring needed to configure this example is:

CALC VALUE 1	**CALC VALUE** 2	**CALC VALUE** 3
0.5000 LV 1	0.5000 RV 1	0.5000 CV 1
ADD	ADD	ADD
0.5000 LV 2	0.5000 RV 2	0.5000 CV 2
WIRED TO	**WIRED TO**	**WIRED TO**
NOTHING	NOTHING	PRCS VAR1

A Program to Control on the Maximum of two Inputs when Heating, the Average when Soaking and the Minimum when Cooling

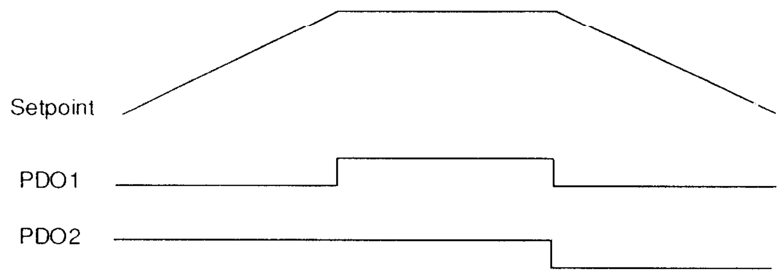
Setting up the instrument for this example falls into three separate activities. The first is to design the user wiring to calculate the maximum, average and minimum then to use the select on register operators to route the correct value to the PV in the three stages of the program. The second part is to configure the programmable logic registers to use the programmer digital outputs which identify the three stages of the program to select the appropriate calculated values. (i.e. maximum, minimum or average). The final part is to enter the program and set up the correct pattern of digital outputs in every segment.

The necessary user wiring of calculated values and the programmable logic is shown below:



Programmer with User Wiring to use Max, Mean and Min during Ramps and Dwells

The two instrument inputs are LV1 and LV2. They are wired to three calculated values that calculate the average (CV1), maximum (CV2) and minimum (CV3). CV4 selects between the average and the maximum and CV5 selects between the minimum and CV4. CV5 chooses the minimum if Register 2 (REG2) is OFF. Since Programmer Digital Output 2 (PDO2) is wired to REG2 setting this output OFF in cooling segments will ensure that the minimum is routed to the PV when cooling, and the state of PDO1 makes no difference. If PDO2 is ON then CV4 is routed to PV so PDO1 influences the choice between maximum and average, so in heating segments PDO1 must be OFF and PDO2 must be ON and in the dwells both must be ON. The diagram shows the program with the correct digital outputs.



The wiring of the calculated values to needed for this example is:

CALC VALUE 1	**CALC VALUE 2**	**CALC VALUE 3**
0.5000 LV 1	1.000 LV 1	1.000 LV 1
ADD	SEL MAX	SEL MIN
0.5000 LV 2	1.000 LV 2	1.000 LV 2
WIRED TO NONE	**WIRED TO** NONE	**WIRED TO** NONE

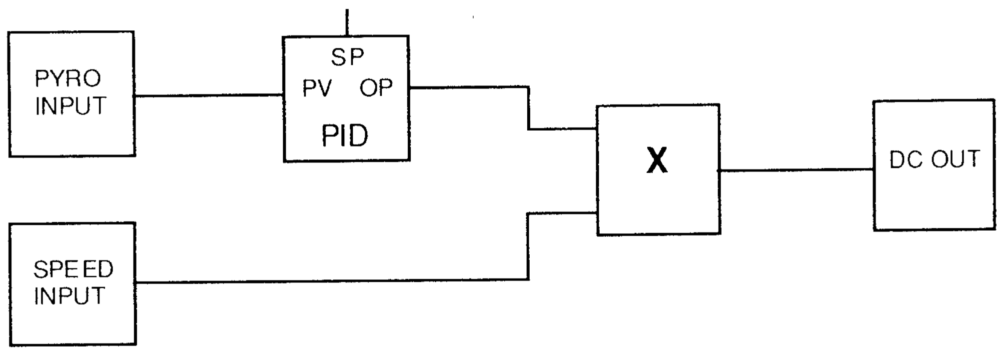
CALC VALUE 4	**CALC VALUE 5**
1.000 CV 1	1.000 CV 4
SEL REG 1	SEL REG 2
1.000 CV 2	1.000 CV 3
WIRED TO NONE	**WIRED TO** PRCS VAR 1

The following wiring of programmable logic registers is also needed to route the programmer digital outputs to the calculated values select on register operator:

REGISTER 1	**REGISTER 2**
PRG DG 1	PRG DG 2
NONE	NONE
NONE	NONE
WIRED TO NONE	**WIRED TO** NONE

Modulating the PID Power Output by a Remote Input

The application where this example comes from is heating a moving film with infra-red elements and sensing the temperature with a pyrometer. If the film stops moving the section seen by the pyrometer cools so the PID delivers full heat to a different part of the film that is already hot. To prevent this the output of the PID is modulated by the line speed as the diagram shows. One significant aspect of this example is that Calculated Values are not just used to condition inputs. Here they are modifying the output of the PID.



If the line speed comes from a remote input module then the calculated value configuration needed is:

CALC VALUE 1

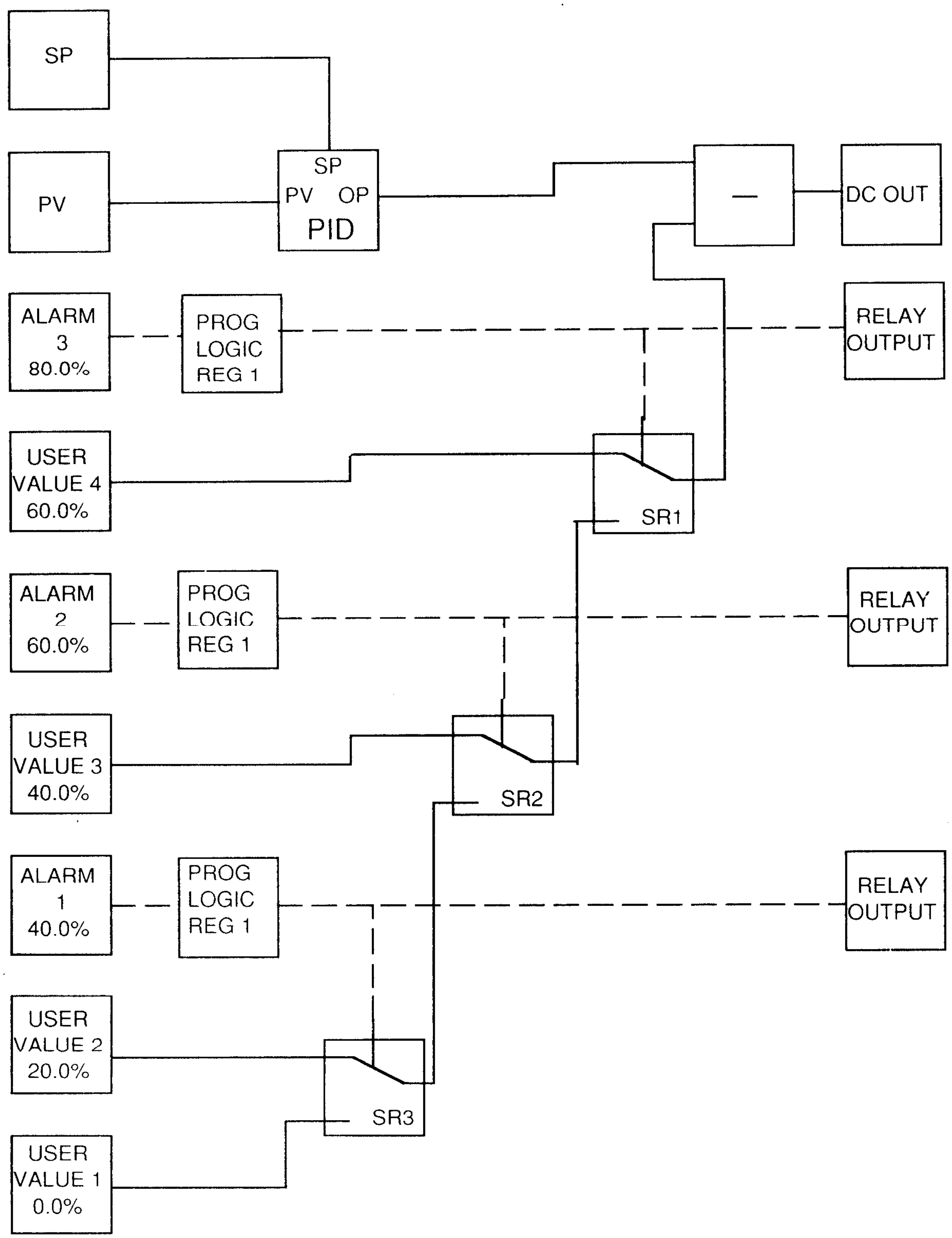
1.000 OP 1
MULTIPLY
1.000 RV 1

WIRED TO
NOTHING

To send the modulated PID output though a DC control module set the slot function for the module to CALC VALUE 1.

Transmitting the PID output through a Combination of Analogue DC and ON-OFF Outputs

Sometimes in a heating application one heater has full proportional control and additional heaters are switched in to boost the power when necessary. This example shows a set of calculated values where three auxiliary heaters are switched in each boosting the output power by 20% to complement a proportional heater delivering 40% of the PID output. The power delivered by the proportional heater is reduced each time a new heater is switched in. The advantage of the 20% - 40% mix is that alarm hysteresis can prevent excessive switching near the changeover points.



User Wiring to Drive One Proportional and Three Switched Control Outputs

Chapter 5 USER DEFINED SCREENS

Introduction

The 900 EPC provides User Defined Screens to allow pages to be created that display the values relevant to a particular application describing the values with text that is meaningful in that application. There are six User Defined Screens in a dual loop programmer or controller PLUS and three in a single loop programmer or controller PLUS.

Availability

All 900 EPC instruments can be configured to have an alternative start-up screen displayed while the instrument is performing its power-up routine. To configure this change the SCREEN CONF from EUROTHERM to CUSTOM in configuration mode under the menu USER CONFIG I SCREEN CONF.

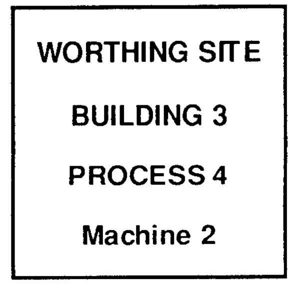
All programmers can be configured to have User Defined Screens that display values. To achieve this NO USER SCRNS must be set to USER SCRNS in the USER CONFIG I USER WIRING I AVAILABILTY menu. Controller instrument types can be configured to have User Defined screens provided they are built using programmer microboards.

Alternative Start-Up Screen

The alternative start-up screen consists of four lines of up to 13 characters of text. The full upper and lower case alphabet, digits and some special symbols can be used in the text. The text can only be set up over comms and is easily achieved using the Eurotherm supervisory package, IPSL. However, for those implementing their own comms packages, each line of text on the screen has its own comms mnemonic (T1 to T4). The character string is written to the appropriate mnemonic. For full details on digital communications please refer to the 900 Series Digital Communications Handbook, part no. HA023776. The special symbols available are :

<table>
<tr><th>Symbol</th><th>String Character</th><th>Symbol</th><th>String Character</th></tr>
<tr><td>%</td><td>%</td><td>Superscript 2</td><td>_(underline)</td></tr>
<tr><td>$</td><td>$</td><td>Superscript 3</td><td>'</td></tr>
<tr><td>&</td><td>&</td><td>Space</td><td>!</td></tr>
<tr><td>+</td><td>+</td><td>Degree sign</td><td>^</td></tr>
<tr><td>-</td><td>-</td><td>Down arrow</td><td>[</td></tr>
<tr><td>(</td><td>(</td><td>Registered trademark symbol (left hand)</td><td>{</td></tr>
<tr><td>)</td><td>)</td><td>Registered trademark symbol (right hand)</td><td>}</td></tr>
<tr><td>"</td><td>"</td><td>TM trademark symbol (super script T)</td><td>|</td></tr>
<tr><td>/</td><td>/ (or;)</td><td>TM trademark symbol (superscript M)</td><td>~</td></tr>
<tr><td><</td><td><</td><td></td><td></td></tr>
<tr><td>></td><td>></td><td></td><td></td></tr>
<tr><td>High horizontal bar</td><td>=</td><td></td><td></td></tr>
<tr><td>Sub-script 2</td><td>|</td><td></td><td></td></tr>
</table>

The alternative start-up screen can be used by O.E.M.s to promote their own company and that of their product whereas end users with large sites might use this screen to indicate the normal location of the instrument. When an instrument is removed for recalibration the screen can be used as a quick and simple way of determining where it should be returned.
Such a screen could look like this:



Example of an End User Start-Up Screen

User Defined Screens for Displaying Values

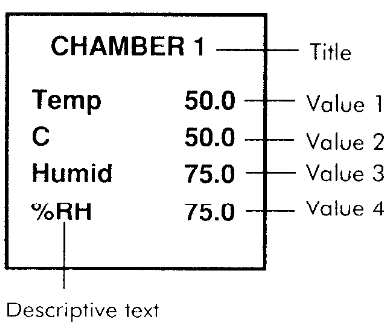
There are 5 user defined screens which can be used to display values in a dual loop instrument:

A Dual loop summary page which has a title and four values
Two Loop summary pages (one for each loop) with a title and four values
Two Loop status pages (one for each loop) with a title, three values, a status window and a scroll list.

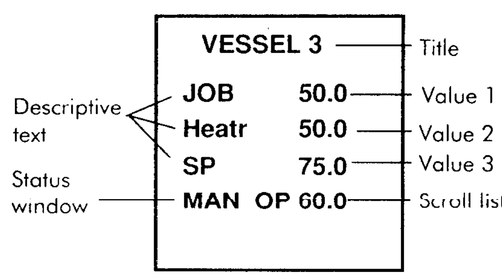
A single loop instrument has two screens:

A Loop summary page with a title and four values
A Loop status page with a title, three values, a status window and a scroll list.

All titles can be up to 13 characters long with the same characters available as described above. The displayed values can be described with up to 5 characters.



Example of a User Defined Loop Summary Screen



Example of a User Defined Loop Status Screen

Any value that has a comms mnemonic can be displayed on a User Defined screen. These screens are easily created using the Eurotherm Supervisory package, IPSL. It is not possible to create the user screens directly from the instrument.

Examples

Dual Loop display with Alterable Setpoints

It is possible to create a dual loop summary page with alterable setpoints provided the main local setpoint is the only setpoint source used. Make value 1 display loop 1 process variable (1PV), value 2 display loop 1 setpoint (1SL), value 3 display loop 2 process variable (2PV) and value 4 loop 2 setpoint (2SL). The screen could look something like this:

OVERVIEW PAGE	
PV1	50.0
SP	50.0
PV2	50.0
SP	75.0

Dual Loop Summary Screen with Alterable Setpoints

Blank Display

It is possible to create a blank display by selecting to display values that are not configured and by writing null (empty) strings of text to the title and value descriptions. Such a screen would be used in dark rooms in the film processing and manufacturing industries.

Message Broadcast System

The four lines of text used to create the alternative start-up screen can be displayed on a user screen. Having created such a user screen a supervisory system such as IPSL can use it to display a message. Such a screen might look like this:

JOHN-PLEASE
COME TO MY
OFFICE NOW
THANKS TONY

or

START THE
CONVEYER
BELT NOW

Message Display System provided by a User Defined Screen

User Defined Screens and User Wiring

User Wiring is described in chapter 4. The values used and calculated by User Wiring can be displayed on User Defined screens. This combination is very flexible, allowing the average, maximum and minimum of four inputs to be calculated and displayed for example. The setpoint is displayed as the fourth value.
The screen could look like this:

INPUT SUMMARY	
MAX	69.9
MIN	47.3
AVE	57.1
SP	57.0

User Defined Screen displaying User Wiring Values

Customising the PV1 and PV2 descriptors on Standard screens

The PV1 and PV2 descriptors that appear on the dual loop summary page, loop summary page, bargraph page and some programmer pages can be changed to any text of up to 3 characters. The text can be made up from any of the characters described at the beginning of this chapter. This can be achieved by using IPSL or by writing to 1CT and 2CT using communications.

Chapter 6 USING THE REAL TIME CLOCK FOR TIMED EVENTS

Introduction

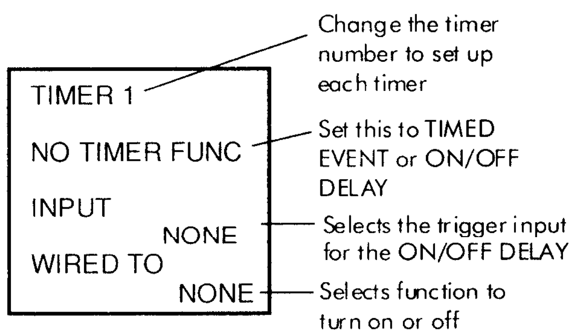
There are four timers in the 900 EPC, introduced at software versions 5.11 and 2.50, in place of the daily scheduler feature. This daily scheduler function can be achieved by using one of the timers. Each of the timers can be either of two types :

TIMED EVENT - This is used to turn functions on or off at specific times of the day or week.

ON OFF DELAY - This is used to turn functions on or off after a 'short' delay.

Configuration

To be able to configure the timers it is first necessary to ensure that they have been made available. This is achieved by checking that the LOOP INDEP page displays TIMERS and not NO TIMERS. The LOOP INDEP page is reached under USER CONFIG | FN AVAILABLE | LOOP INDEP. Once the timers have been made available they can be configured under USER CONFIG | TIMER CONF. This page is as shown :

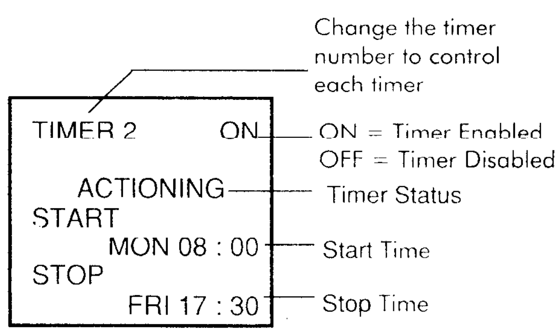


Timer Configuration Page

When wiring the timers into the programmable logic or to a digital output, the WIRED TO field can be left as NONE. The input of the register or the slot function of the digital output should be set to TIMER 1, TIMER 2, TIMER 3 or TIMER 4 as appropriate.

Operation

For the timers to be functioning the real time clock must be RUNNING. The timers are operated from LEVEL 2 (or LEVEL 3) | TIME CONTROL | TIMERS.
If a TIMER is a TIMED EVENT the timer page will look like this:



To be able to edit the start and stop times the timer must be OFF. The start and stop times have three fields, day, hour and minute. The day field has the following options:

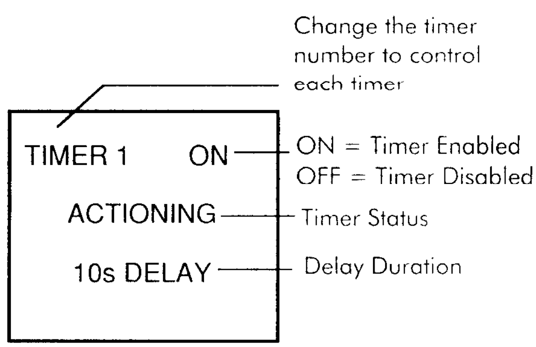
ALL	Every Day	THU	Thursday
MON	Monday	FRI	Friday
TUE	Tuesday	SAT	Saturday
WED	Wednesday	SUN	Sunday
M-F	Monday to Friday inclusive.		

The example above will switch on the function at 08:00 on Monday and turn it off again at 17:30 on Friday. The function has been previously selected in configuration.

The timer status is blank when the timer is OFF. When the timer is ON the timer status will either be WAITING if the function has yet to be switched on or ACTIONING once the function has been switched on. The timer status returns to WAITING when the function is switched off again.

On / Off Delays

To edit the delay duration the timer must be off. The delay duration can be set in the range 0 to 99 999 seconds (approximately 27 hours and 46 minutes). The timer status is blank when the timer is off. When the timer is first turned on the status will change to WAITING. Once the input to the timer becomes true the status will change to TRIGGERED with the time since being triggered being displayed on the line below.



Timer Operation Page - On/Off Delay

If a TIMER is an ON / OFF DELAY the timer page will look like that above:
Once the delay period has elapsed the status will change to ACTIONING and the function, which was selected in configuration, is switched on. After the timer state changes to actioning the timer state is ANDed with the input signal to the timer. This ensures that when the input changes, the timer status returns to WAITING and the output goes to off. If the input signal is only momentary the delay enters the TRIGGERED state and after the delay period the output goes ON for 100 ms only. This will trigger any 'edge sensitive' functions like RUN.

General

Timers will always power up in the OFF state. The timers are switched OFF after a powerfail because if events are missed while the power is off then the system may fall into an indeterminate state. To enable timers permanently, programmable logic inputs can be wired to TIMER ON/OFF.

Example Applications

Mimicing the PC3000 timer functions.

There are three types of timer in the PC3000 : On Delays, Off Delays and Pulse Timers.
The PC3000 On Delay output can only be high when its input is high. To achieve this with a 900 EPC timer it is necessary to mask out the 100 ms pulse the 900 EPC gives even if the timer input is low when the delay time has elapsed. The programmable logic given below will achieve this :

REGISTER 1	=	TIMER 1 ACTIONING AND DIG IN 1
TIMER 1	=	DIG IN 1

The PC3000 Off delay is high when its input is high and remains high for the duration of the delay once the input has gone low. This can be achieved using programmable logic as follows :

REGISTER 1	=	NOT DIG IN 1 AND REGISTER 2 -Detect falling edge
REGISTER 2	=	DIG IN 1 - Last state of DIG IN 1
REGISTER 3	=	DIG IN 1 OR REGISTER 1 - DIG IN 1 high or just gone low
REGISTER 4	=	REGISTER 3 OR TIMER 1 TRIGGERED - Final result
TIMER 1	=	REGISTER 1

So register 4 in the above example emulates the operation of the PC3000 Off delay.
The TRIGGERED state of the 900 EPC delay timer is equivalent to thePC3000 Pulse Timer.

Load and Run program 1 at 7:00 a.m.

This example also uses the timers in combination with the programmable logic to load and run the programme once at 7:00 a.m. everyday. The Programmable Logic configuration is as follows:

REGISTER 1	=	REGISTER 2	WIRED TO	RUN
REGISTER 2	=	REGISTER 3	WIRED TO	LOAD PRG LP1
REGISTER 3	=	REGISTER 5 AND NOT REGISTER 4	WIRED TO	RESET
REGISTER 4	=	REGISTER 5	WIRED TO	NONE
REGISTER 5	=	TIMER1ACT	WIRED TO	NONE

This PLC wiring causes the programmer to be reset at 07:00, load program 1 on to loop 1 at 07:00 plus 100ms and runs the programmer at 07:00 plus 200ms. The timer should be configured as a timed event and wired to LP1 LSD PROGNO (the least significant digit of the program number for loop 1). The start time should be ALL 07:00 and the stop time should be ALL 07:01.

Chapter 7 TOTALISERS

Introduction

The 900 EPC comprises four totalisers to integrate or accumulate analogue values within the instrument. These totalisers can be used to measure energy doses by accumulating PV or output or perform simple statistical process control by accumulating error or other quantities obtained using calculated values. The totalisers have a trigger level which when exceeded can set an alarm output to alert an operator or move the 900 EPC to a different operating state using programmable logic.

The totalisers are all updated five times per second but the incoming value is prescaled so that the totalisation appears to happen every second. For example if the input was an extrusion rate of 10 metres per second then after 60 seconds the total would be 600 metres. Totalisers can countdown as well as up. Totalisers have a maximum displayed resolution of 5 digits though they work internally to a greater precision to ensure that no incoming data is lost.
Totalisers are only available on programmer microboards.

Inputs

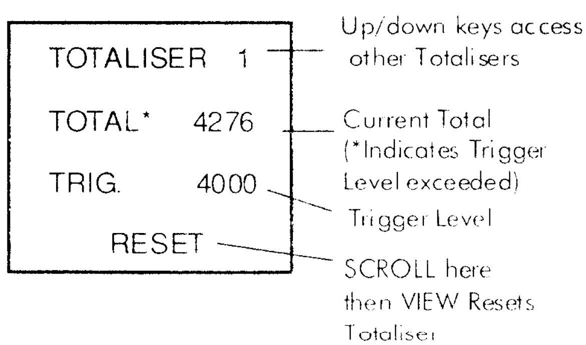
The inputs to the totalisers are:-

PV1, PV2	Process variable for loops 1 and 2 (see Figure 1).
LV1, LV2	Linearised values from the two instrument process inputs
RV1, RV2	Values from up to two remote inputs
OP1, OP2	PID output for loop 1 and 2
SP1, SP2	Working setpoint loop 1 and 2
PSP1, PSP2	Programmer setpoint for loop 1 and 2
VP1, VP2	Valve position for loop 1 and 2
ERR1, ERR2	Error, PV - SP for loop 1 and 2
CV1 - CV8	Calculated values 1 to 8
UV1 - UV4	User values 1 to 4

Totaliser inputs are configured under USER CONFIG/ TOTALISER CONF where the input for up to four totalisers is set up.

Viewing Totalisers

When any of the four totalisers have been configured then a page becomes available at all levels like the alarms page where you can inspect the current total.
A typical totaliser page is shown:



Digital Inputs and Outputs

A digital output can be configured to become active when a specified totaliser exceeds its trigger value or when any totaliser exceeds its value.
A digital input can be configured to reset any one or all totalisers.

You can wire the totaliser digital output to the totaliser reset digital input to reset a totaliser when it reaches its trigger level. This will generate a saw tooth waveform. Alternatively you could use a Programmable Logic Register to do this wiring as follows:

```
REGISTER      1

  TLSR OP     1
  NONE
           NONE
  WIRED TO

 RESET TLSR  1
```

Examples

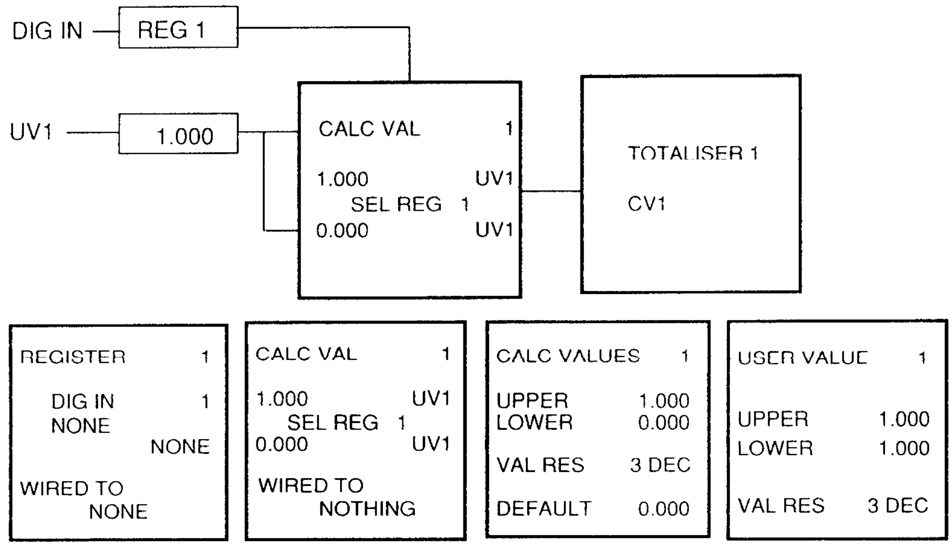
A more detailed application for the totaliser is a customer who uses the 900 EPC to control an ageing chamber for fabric and plastics exposed to intense light. Rather than ageing on time the customer wants to measure degradation of samples after receiving a measured dose of energy. The 900 EPC is controlling the irradiation of the samples in watts/m^2 so he uses a totaliser to accumulate the PV giving received energy in Joules/m^2. The trigger level is set to give a pulse and reset the totaliser every 0.1 Joules and at the appropriate time a PLC counting these pulses stops the test.

An alternative energy measurement is to totalise output power up to a given value. This is often done in mixing applications (rubber, chocolate) where the process moves to a next stage after receiving the necessary amount of mixing.

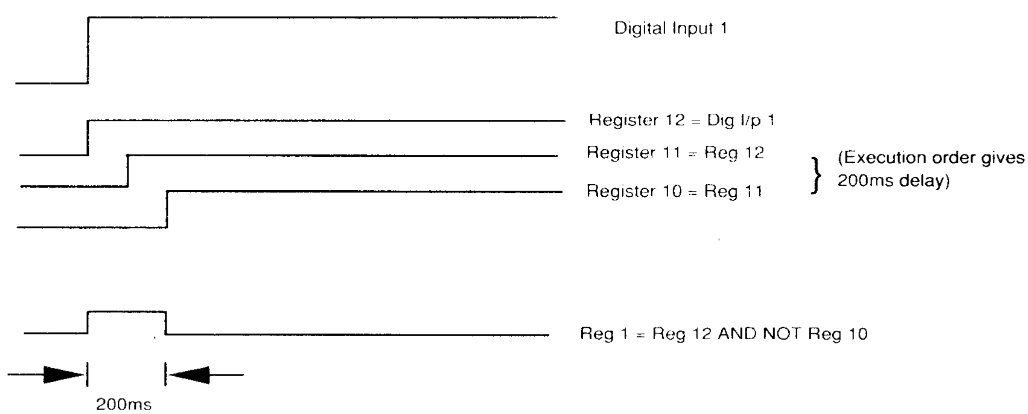
One further example is to totalise error (or even better the absolute value of error from a calculated value). If the trigger level is ever reached as the process moves above and below setpoint then a problem exists and the operator should be alerted.

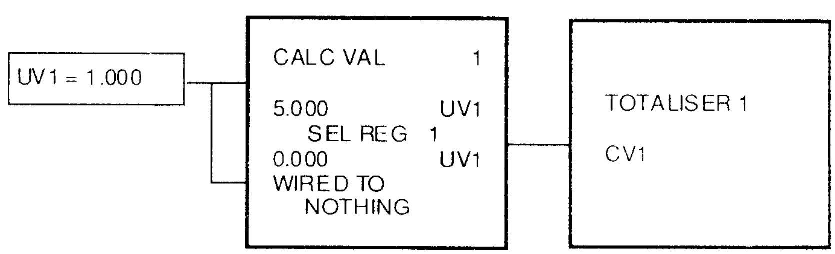
What the Totalisers are Not

The totalisers are not counters nor are they timers but with some help from the user wiring the totalisers can perform both these functions.
A timer increases at a constant rate when a digital input is true.
A totaliser can be made to work as a timer using the configuration shown:



A counter increases by one each time an event occurs such as a switch being closed. To turn a totaliser into a counter we must convent the incoming edge to a 200 millisecond pulse (the update period of the totaliser) and add five to the totaliser (not one to allow for scaling up to one update per second).





Every time the digital input is made the totaliser will increase by one. The edge input need not come from a digital input. It could come from an alarm which is also used to enable cascade or output limit if deviation is outside acceptable limits.

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