NOVUS N1020 Temperature Controller Instruction Manual

Contents

NOVUS N1020 Temperature Controller

INTRODUCTION

The N1020 is a small and yet powerful temperature controller. It accepts most of the temperature sensors used in industry and its 2 outputs can be configured independently as control or alarm output. It also embeds an auto-adaptative PID control algorithm for best system performance. Configuration can be performed either directly on the controller or via the USB interface once QuickTune software has been installed on the computer to be used.

Once connected to USB, the device will be recognized as a serial communication COM port operating with Modbus RTU protocol. Through the USB interface, even if disconnected from the power supply, the configuration performed in a piece of equipment can be can be saved in a file and repeated in other pieces of equipment that require the same configuration. It is important that the users read carefully this manual before using the controller. Verify if the release of this matches the instrument version (the firmware version is shown when the controller is energized. The N1020 main characteristics are

- LED Display, red, high brightness.
- Multi-sensor universal input thermocouples, Pt100 and 50 mV.
- Self-tuning PID parameters.
- 2 outputs: 1 relay and 1 logical pulse for SSR.
- Output functions: Control, Alarm1 and Alarm 2.
- 8 distinct alarm functions.
- Programmable timer.
- Function key for enabling/disabling outputs, resetting the timer or turning the timer ON/OFF.
- Programmable soft start.
- Rate function.
- Password for parameters protection.
- Capability of restoring factory calibration.

USB INTERFACE

The USB interface is used to CONFIGURE, MONITOR or UPDATE the controller FIRMWARE. The user should use QuickTune software, which offers features to create, view, save and ope settings from the device or files on the computer. The tool for saving and opening configurations in files allows the user to transfer settings between devices and perform backup copies. For specific models, QuickTune allows to update the firmware internal software of the controller via the USB interface. For MONITORING purposes, the user can use any supervisory software SCADA or laboratory software that supports the MODBUS RTU communication over a serial communication port. When connected to a computer's USB, the controller is recognized as a conventional serial port COM x. The user must use QuickTune software or consult the DEVICE MANAGER on the Windows Control Panel to identify the COM port assigned to the controller. The user should consult the mapping of the MODBUS memory in the controller's communication manual and the documentation of the supervision software to start the MONITORING process. Follow the procedure below to use the USB communication of the device

1. Download QuickTune software from our website and install it on the computer.
2. The USB drivers necessary for operating the communication will be installed with the software.
3. Connect the USB cable between the device and the computer.
4. The controller does not have to be connected to a power supply.
5. The USB will provide enough power to operate the communication other device functions may not operate.
6. Run the QuickTune software, configure the communication and start the device recognition.
7. The USB interface IS NOT SEPARATE from the signal input (PV) or the controller's digital inputs and outputs.
8. It is intended for temporary use during CONFIGURATION and MONITORING periods.
9. For the safety of people and equipment, it must only be when the piece of equipment is completely disconnected from the input/output signals.
10. Using the USB in any other type of connection is possible but requires a careful analysis by the person responsibl for installing it.
11. When MONITORING for long periods of time and with connected inputs and outputs, we recommend using the RS485 interface, which is or optional in most of our products.

INSTALLATION / CONNECTIONS

The controller must be fastened on a panel, following the sequencemof steps described below

- Prepare a panel cut-out according Specifications;
- Remove the mounting clamps from the controller;
- Insert the controller into the panel cut-out;
- Slide the mounting clamp from the rear to a firm grip at the panel.

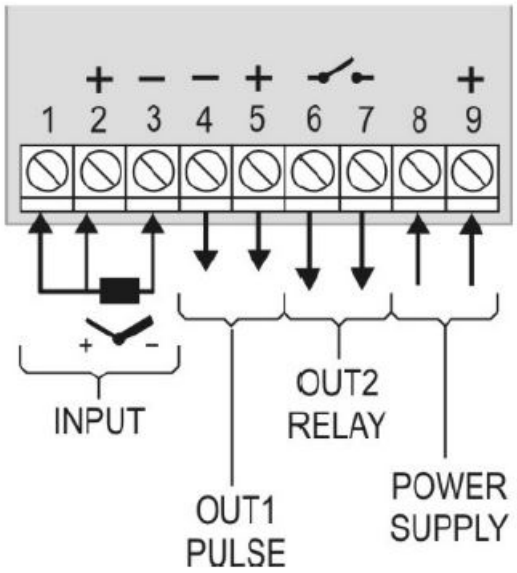
RECOMMENDATIONS FOR THE INSTALLATION

All electrical connections are made to the screw terminals at the rear of the controller. They accept wire sizes from 0.5 to 1.5 mm2 16 to 22 AWG). The terminals should be tightened to a torque of 0.4 Nm 3.5 lb in.

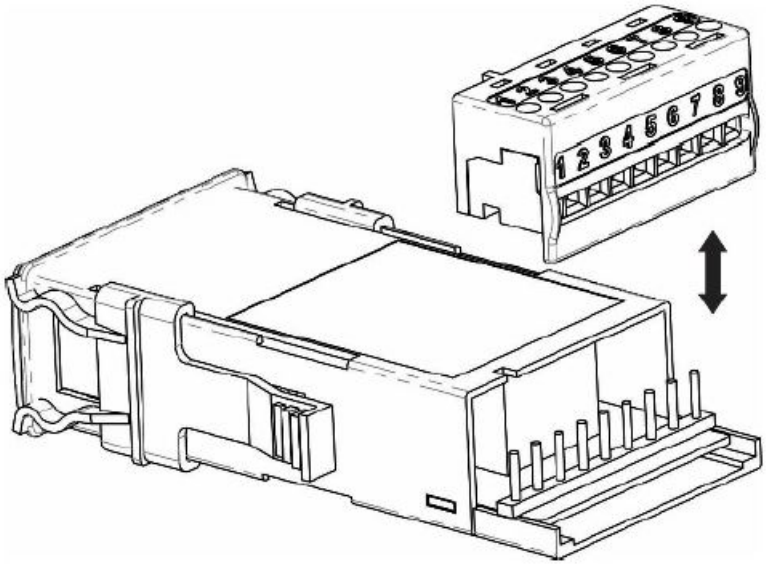
- To minimize the pick-up of electrical noise, the low voltage DC connections and the sensor input wiring should be routed away from high current power conductors.
- If this is impractical, use shielded cables. In general, keep cable lengths to a minimum.
- All electronic instruments must be powered by a clean mains supply, proper for instrumentation.
- It is strongly recommended to apply RC'S FILTERS noise suppressor to contactor coils, solenoids, etc.
- In any application it is essential to consider what can happen when any part of the system fails.
- The controller features by themselves can't assure total protection.

ELECTRICAL CONNECTIONS

The controller complete set of features. The features loaded in a particular unit are shown on its label



Removal of the Controller Back Connector



FEATURES

INPUT TYPE SELECTION

Select the input type in parameter TYPE

TYPE	CODE	RANGE OF MEASUREMENT
J	Tc j	Range: -110 to 950 ºC -166 to 1742 ºF
K	Tc k	Range: -150 to 1370 ºC -238 to 2498 ºF
T	Tc t	Range: -160 to 400 ºC -256 to 752 ºF
N	Tc n	Range: -270 to 1300 ºC -454 to 2372 ºF
R	Tc r	Range: -50 to 1760 ºC -58 to 3200 ºF
S	Tc s	Range: -50 to 1760 ºC -58 to 3200 ºF
B	Tc b	Range: 400 to 1800 ºC 752 to 3272 ºF
E	Tc e	Range: -90 to 730 ºC -130 to 1346 ºF
Pt100	Pt	Range: -200 to 850 ºC -328 to 1562 ºF
0 to 50 mV	L0.50	Linear. Programmable indication -1999 to 9999

OUTPUTS

The N1020 offers two output channels, user configurable as Control output, Alarm 1 output or Alarm 2 output.

OUT1

Logical pulse, 5 Vdc / 25 mA, available at terminals 4 and 5.

OUT2

Relay SPST-NA, 1.5 A / 240 Vac, available at terminals 6 and 7.

Note
The outputs can be configured independently from each other, for example, both can be control outputs at the same time.

CONTROL OUTPUT

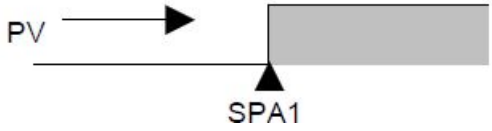
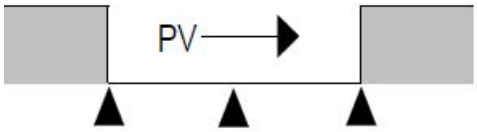
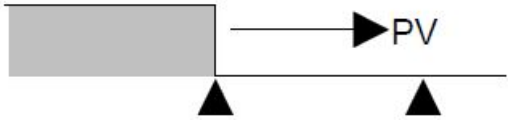
The control strategy can be configured as ON / OFF or PID.

ALARM OUTPUT

There two alarms available in the N1020. The alarms can be assigned to either output, logical or relay. The alarm functions are described below.

ALARM FUNCTIONS

The alarms can be configured to operate with nine different functions.

<table>
<tr><td>off</td><td>Alarms turned Off.</td></tr>
<tr><td>lo</td><td>Alarm of Absolute Minimum Value. Triggers when the value of measured PV is below the valu e defined for alarm Setpoint (SPA1 or SPA2).
 
</td></tr>
<tr><td>ki</td><td>Alarm of Valor Absolute Maximum Value. Triggers when the value of measured PV is the valu e defined for alarm Setpoint.
 
</td></tr>
<tr><td rowspan="3">dif</td><td colspan="2">Alarm of Differential Value. In this function the parameters SPA1 and SPA2 represent the devi ation of PV in relation to the SP of CONTROL.</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>SPA1 positive</td><td>SPA1 negative</td></tr>
<tr><td rowspan="3">difl</td><td colspan="2">Alarm of Minimum Differential Value. It triggers when the value of PV is below the defined poin t by (using the Alarm 1 as example</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>SPA1 positive</td><td>SPA1 negative</td></tr>
<tr><td rowspan="3">difk</td><td colspan="2">Alarm of Valor Maximum Differential Value. Triggers when the value of PV is above the define d point by (using Alarm 1 as example):</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>SPA1 positive</td><td>SPA1 negative</td></tr>
<tr><td>t.0n</td><td colspan="2">Timer ON alarm. Sets alarm output ON when timer is runing.</td></tr>
<tr><td>t.end</td><td colspan="2">Timer end. Configures the alarm to actuate when the timer expires.</td></tr>
<tr><td>ierr</td><td colspan="2">Sensor Break Alarm. Activated when the input signal of PV is interrupted, out of the range or when Pt100 in short-circuit.</td></tr>
</table>

The above examples also apply to Alarm 2.

Important note
Alarms configured with the ki, dif, and difk functions also trigger their associated output when a sensor fault is

identified and signaled by the controller. A relay output, for example, configured to act as a High Alarm (ki), will operate when the SPAL value is exceeded and also when the sensor connected to the input is broken.

Alarms Timer Modes Temporization

The controller alarms can be configured to perform 4 timer modes

MODE	A1t1 A2t1	A1t2 A2t2	ACTION
Normal Operation	0	0	
Activation for a defined time	1 to 6500 s	0	
Activation with delay	0	1 to 6500 s	
Intermittent Activation	1 to 6500 s	1 to 6500 s	

The signs associated to the alarms will light when the alarm condition is recognized, not following the actual state of the output, which may be temporarily OFF because of the temporization.

Initial Blocking of Alarm

The initial blocking option inhibits the alarm from being recognized if an alarm condition is present when the controller is first energized or after a transition from run YES NO. The alarm will be enabled only after the occurrence of a non alarm condition followed by a new occurrence for the alarm. The initial blocking is useful, for instance, when one of the alarms is configured as a minimum value alarm, causing the activation of the alarm soon upon the process start-up, an occurrence that may be undesirable.
The initial blocking is disabled for the sensor break alarm function.

RAMP AND SOAK FUNCTION

Allows reaching the SP value gradually. The value of SP is increased gradually from an initial value (PV value) until it reaches the set value. The rate parameter sets this increase for SP in degrees per minute. The Ramp function will work when turn on the controller, enable control (RUN = YES) or when the SP value is changed. A value equal to zero (0) in the rate parameter disables the Ramp function.

TIMER FUNCTION

The N1020 embeds a timer function (decreasing) for applications that require particular process duration. Once defined the time interval in the T1me parameter, the timer will
START When PV reaches the temperature programmed in the SP parameter.

- When enabling the control (RUN = YES).
- By pressing the F key when configured to Timer reset mode the timer is reloaded with the T1me parameter

and restarts counting.

- By pressing the F key in ON/OFF mode stops the timer counting pressing it again, resumes the counting.
- When the timer expires, the two possible actions can be Disables de control (RUN→ NO) or Activate the alarm.

FUNCTIONS FOR THE F KEY

The F key on the frontal keypad is meant for special commands, as follows

- Enable outputs (identically to the RUN parameter).
- Timer reset: – reloads the timer and initiates a new time counting.
- Timer ON/OFF. Timer holds or resumes counting each time the F key is pressed.
- Keeping the F key pressed for 3 seconds resets the timer reloads the timer to the value set in time, initiating a new time counting.

Note
When the F key is configured as RUN = YES/NO (RUN = f.key), the controller outputs are born disabled after powers up.

SOFT START

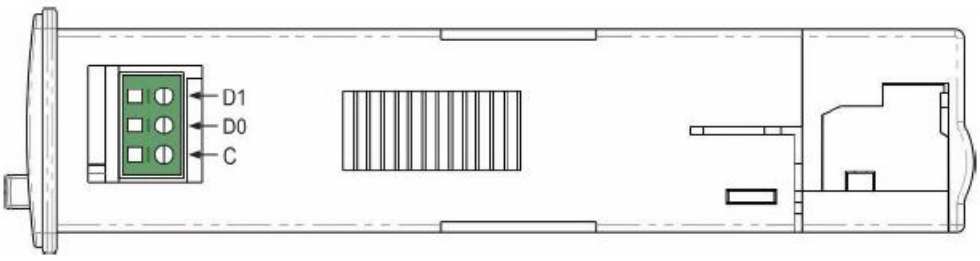
The Soft-start function is generally used in processes that require slow start-up, where the instantaneous application of 100% of the available power to the load may cause damages to parts of the system. In order to disable this function, the soft-start parameter must be configured with 0 zero.

OFF SET

Allows fine trimming the PV indication to compensate for sensor errors. Default value: zero.

SERIAL COMMUNICATION

For full documentation download the Registers Table N1020 for Serial Communication on our website www.novusautomation.com

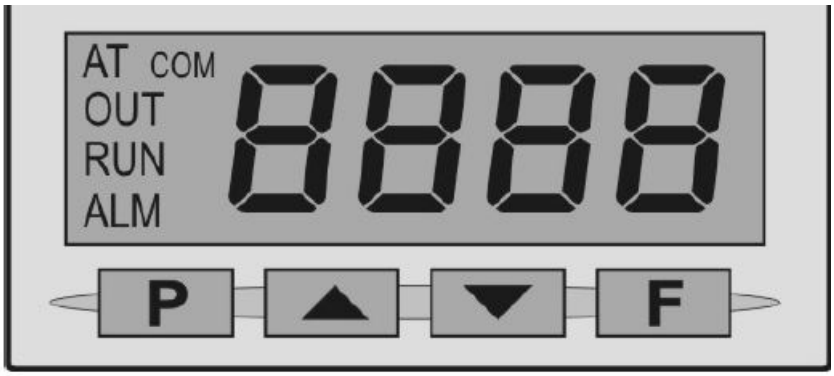


The table below helps you connect the RS485 communication interface connectors

D1	**D**	**D +**	**B**	Bidirectional data line
D0		**D –**	**A**	Inverted bidirectional data line
C				Optional connection that improves the performance of the communication.
GND				

OPERATION

The controller's front panel, with its parts, can be seen



Display

Displays the current value of PV. When configuring a parameter, the display alternates between the parameter prompt and its value the parameter value is shown with a light blinking to differentiate it from the parameter prompt. The display contains also the signs AT, OUT, RUN ALM and COM

AT Indicator

Stays ON while the controller is in tuning process.

OUT Indicator

For relay or pulse control output; it reflects the actual state of the output.

RUN Indicator

Indicates that the controller is active, with the control output and alarms enabled. (RUN=YES).

ALM Indicator

Signalize the occurrence of alarm condition. It lights when either alarm is active.

COM Indicator

Flashes when there is RS485 activity.

P Key

Used to walk through the menu parameters. Increment key and Decrement key: allow altering the values of the parameters.

F Key

Accesses special functions: RUN (toggles YES/NO) and the two modes of timer control.

STARTUP

When the controller is powered up, it displays its firmware version for 3 seconds, after which the controller starts normal operation. The value of PV is then displayed and the outputs are enabled. In order for the controller to operate properly in a process, its parameters need to be configured first, such that it can perform accordingly to the system requirements. The user must be aware of the importance of each parameter and for each one determine a valid condition. The parameters are grouped in levels according to their functionality and operation easiness. The 5 levels of parameters are:

1. Operation Level
2. Tuning Level
3. Alarms Level
4. Configuration Level
5. Calibration Level

The P key is used for accessing the parameters within a level. Keeping the P key pressed, at every 2 seconds the controller jumps to the next level of parameters, showing the first parameter of each level: PV >> atvn >> fva1 >> type >> pass >> PV. To enter a particular level, simply release the P key when the first parameter in that level is displayed. To walk through the parameters in a level, press the P key with short strokes. The display alternates the presentation of the parameter prompt and its value. The parameter value is displayed with a light blinking to differentiate it from the parameter prompt. Depending on the level of parameter protection adopted, the parameter PASS precedes the first parameter in the level where the protection becomes active. See section CONFIGURATION

PROTECTION

Table with the complete sequence of levels and parameters is presented.

Note
It is recommended to disable/suspend the control (rvn = NO) whenever it is necessary to change the device settings.

DESCRIPTION OF THE PARAMETERS

OPERATION LEVEL

PV	PV indication
Timer	Timer remaining time. Only shown when the Timer function is in use. T1me ¹ 0 HH:MM .
SP	Control SP adjustment.
T1me	Sets the Timer, 00:00 to 99:59 (HH:MM).
Rate	RATE OF PV RISE from the current PV to the SP value. In degrees/minute.
rvn	Enables control outputs and alarms. YES Outputs enabled. NO Outputs disabled. f.key **F** key assumes control over the RUN command.

TUNING LEVEL

Atvn Auto-tune	Defines the control strategy to be taken **off** Turned off no PID tuningFast Fast automatic tuning.Full More accurate automatic tuning.Self Precise + auto – adaptative tuning Rslf Forces ONE new precise automaticprecise + auto – adaptative tuning.TGht Forces ONE new precise automatic + auto – adaptative tuning when Run = YES or con troller is turned on DETERMINING PID PARAMETERSsection for further details on tuni ng strategies.
pb Proportional Band	Proportional Band – Value of the term P of the control mode PID, in percentage of the maximum span of the input type. Adjust of between 0 and 500.0 %.
	Select zero for ON/OFF control.
ir *Integral Rate*	Integral Rate – Value of the term I of the PID algorithm, in repetitions per minute (Reset). Adjustable between 0 and 99.99. Displayed only if proportional band ¹ 0.
dt Derivative Time	Derivative Time – Value of the term D of the control mode PID, in seconds. Adjustable between 0 and 300.0 seconds. Displayed only if proportional band ¹ 0.
Level Time	Pulse Width Modulation PWM period in seconds. Adjustable between 0.5 and 100.0 se conds. Displayed only if proportional band ¹ 0.

kyst *Hysteresis*	Control Hysteresis (in engineering. units): This parameter is only shown for ON / OFF c ontrol (Pb=0). Adjustable between **0** and the measurement input type span.
Action	Control Action: For Auto Mode only. re Control with Revers**e** Action. Appropriate heating. Turns control output on when PV is below SP. dir Control with Direct Action. Appropriate for cooling. Turns control output on when PV is above SP.
sfst Softstart	SoftStart Function –: Time in seconds during which the controller limits the MV value pr ogressively from 0 to 100 %. It is enabled at power up or when the control output is activated. If in doubt set zero (ze ro value disables the Soft start function.
0ut1	Outputs 1 and 2 function:
0ut2	Off not used; trl control output. A1:Alarm 1. A2:Alarm 2 A1a2 Alarm 1 AND Alarm 2 at the same time.

ALARMS LEVEL

Fva1 Fva2 *Function Alarm*	Functions of Alarms. Defines the functions for the alarms among the options.
Sp.a1 Sp.a2	Alarm Setpoint: Tripping points for alarms 1 and 2. Value that defines the poin t of activation for the programmed alarms with the functions **Lo** or **ki**.
	For the alarms configured with **Differential** type functions, this parameter defi nes deviation band.
	Not used for the other alarm functions.
bla1 bla2 Blocking Alarm	Block Alarm 1 and 2: This function blocks the alarms when the controller is energized. **YES** enables initial blocking **NO** inhibits initial blocking
xya1 xya2 *H*ysteresis of Alarm	Alarm Hysteresis. Defines the difference between the value of PV at which th e alarm is triggered and the value at which it is turned off.
A1t1 A2t1 Alarm Time t1	Defines the temporization time t1, for the alarms. In seconds.

A1t2 A2t2 Alarm Time **t2**	Defines the temporization time **t2**, for the alarms. In seconds.
flsh	Allows you to identify the occurrence of alarm conditions by flashing the PV indication o n the display screen. **YES** Enables alarm signaling flashing PV **NO** Disables alarm signaling flashing PV

CONFIGURATION LEVEL

Type	Input Type: Selects the input signal type to be connected to the process variable input. Refer to **Table 1** for the available options.
fltr Filter	Digital Input Filter Used to improve the stability of the measured signal PV Adjustable between 0 and 20. In 0 zero it means filter turned off and 20 means maximu m filter. The higher the filter value, the slower is the response of the measured value.
Dp.po Decimal Point	Selects the decimal point position to be viewed in both PV and SP.
vni **t** Unit	*Unit.* Temperature indication in °C or °F. Not shown for linear inputs.
0ffs *Offset*	Sensor Offset: Offset value to be added to the PV reading to compensate sensor error. Default value: zero.

Spll SP Low Limit	Defines the SP lower limit. To 0-50 mV input type sets the lower range for SP and PV indication.
Spxl SP High Limit	Defines the SP upper limit. To 0-50 mV input type sets the upper range for SP and PV indication.
T1me *Timer*	**Time**. Adjustment. 00:00 to 99:59 HH:MM same function as the one presented in the o peration level
Tm.en *Timer Enable*	Shows a copy of the Timer parameter in the operating level En enables Time paramete r to the operating level. Dis doesn't show the T1me parameter in the operating level
T.str *Timer Start*	Defines the mode for starting the Timer. sP when PV reach the temperature value in SP rvn when RUN →YES f.rst F key reset timer f.stp Fkey start/stop the timer.
T.e.0 Timer End Control Off	Control behavior when the timer expires: YES disables the outputs RUN NO outputs continue to operate.
Rate	Ramp function Establishes the rate of increase of PV, in degrees/minute. Same Rate function as showed in the operating level.
rT.en *Rate Enable*	Shows a copy of the Rate parameter in the operating level. enables the Rate parameter to the operating level. Dis doesn't show the Rate parameter in the operating level
rvn	Enables the control and alarm outputs. YES outputs enabled. NO outputs disabled f.key outputs enabled/disabled function assigned to the F key. Sam e rvn function as showed in the operating level.

rn.en Run Enable	Shows a copy of the rvn parameter in the operating level. En enables the **r**vn parameter in the operating level Dis – doesn't show the **rvn** parameter in the operating level
bavd Baud Rate	*Baud Rate* serial communication. In kbps, with the following speeds available 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6 and 115.2
prty Parity	Parity of the serial communication none Whitout parity Ewem Eve parity Odd parity
Addr	Communication Address. Identifies the controller in the network. The possible address numbers are from 1 to 247.

CONFIGURATION LEVEL

Type Type	Input Type: Selects the input signal type to be connected to the process variable input f or the available options.
fltr Filter	Digital Input Filter Used to improve the stability of the measured signal (PV). Adjustable between 0 and 2 0. In 0 zero it means filter turned off and 20 means maximum filter. The higher the filter value, the slower is the response of the measured value.
Dp.po Decimal Point	Selects the decimal point position to be viewed in both PV and SP.
vni **t** Unit	Temperature indication in °C or °F. Not shown for linear inputs.
0ffs Offset	Sensor Offset: Offset value to be added to the PV reading to compensate sensor error. Default value: zero.
Spll SP Low Limit	Defines the SP lower limit. To 0-50 mV input type sets the lower range for SP and PV i ndication.
Spxl SP High Limit	Defines the SP upper limit. To 0-50 mV input type sets the upper range for SP and PV i ndication.

Timer	Time Adjustment. 00:00 to 99:59 HH:MM same function as the one presented in the op eration level
Tm.en Timer Enable	Shows a copy of the Timer parameter in the operating level enables T1me parameter t o the operating level doesn't show the T1me parameter in the operating level
T.str Timer Start	Defines the mode for starting the Timer when PV reach the temperature value in SP w hen RUN YES F key reset timer F key start/stop the timer.
T.e.(.0 Timer End Control Off	Control behavior when the timer expires: YES – disables the outputs RUN = NO outputs continue to operate.
Rate	Ramp functio Establishes the rate of increase of PV, in degrees/minute. Same Rate function as showed in the operating level.
rT.en Rate Enable	Shows a copy of the Rate parameter in the operating level. En – enables the Rate parameter to the operating level doesn't show the Rate paramet er in the operating level
rvn	Enables the control and alarm outputs. YES outputs enabled. NO outputs disabled outputs enabled/disabled function assigned to the F key. Same rvn function as showed in the operating level.

rn.en *R*un Enable	Shows a copy of the rvn parameter in the operating level. En enables the rvn parameter in the operating level Dis doesn't show the rvn parameter in the operating level
bavd Baud Rate	*Baud Rate* serial communication. In kbps, with the following speeds available 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6 and 115.2
prty Parity	Parity of the serial communication Whitout parity Ewem Eve parity Odd parity
Addr Address	Communication Address. Identifies the controller in the network. The possible address numbers are from 1 to 247.

CALIBRATION LEVEL

All of the input and output types are calibrated in the factory. If a recalibration is required, this should be carried out by a experienced personnel. If this level is accidentally accessed, pass through all the parameters without pressing the or keys.

pass Password	Input of the Access Password. This parameter is presented before the protected levels. See item Protection of Configu ration.
Calibration?	Enables or disables instrument calibration by the user, YES: shows calibration paramet ers No Hides the calibration parameters
Input Low Calibration	See section MAINTENANCE / Input Calibration. Enter the value corresponding to the low scale signal applied to the analog input. Only showed if YES
Input High Calibration	See section MAINTENANCE / Input Calibration. Enter the value corresponding to the full scale signal applied to the analog input. Only showed if alib = YES
rstr *Restore*	Restores the factory calibration for all inputs and outputs, disregarding modifications car ried out by the user.

ovll Output Low Limit	Lower limit for the control output – Minimum percentage value assumed by the control o utput when in automatic mode and in PID. Typically configured with **0 %**. Default value: 0 %
ovkl Output High Limit	Upper limit for the control output – Maximum percentage for the control output when in automatic mode and in PID. Typically configured with 100 %. Default value: 100 %.
Cold Junction	Cold junction temperature controller.
Pas Password Change	Allows defining a new access password, always different from zero.
Prot Protection	Sets up the Level of Protection.
Freq Frequency	Mains frequency. This parameter is important for proper noise filtering.
snk	Shows the four first digits of the controller serial number.
snL	Shows the four last digits of the controller serial number.

CONFIGURATION PROTECTION

The controller provides means for protecting the parameters configurations, not allowing modifications to the parameters values, avoiding tampering or improper manipulation. The parameter Protection (PROt), in the Calibration level, determines the protection strategy, limiting the access to particular levels.

Protection Level	**Protection Levels**
1	Only the Calibration level is protected.
2	Calibration and Tuning levels.
3	Calibration, Tuning and Alarms levels
4	Calibration, Tuning, Alarms and Configuration levels
5	Calibration, Tuning, Alarms, Configuration levels

ACCESS PASSWORD

The protected levels, when accessed, request the user to provide the Access Password for granting permission to change the configuration of the parameters on these levels. The prompt PASS precedes the parameters on the protected levels. If no password is entered, the parameters of the protected levels can only be visualized. The Access Password is defined by the user in the parameter Password Change (PAS.(), present in the Calibration Level. The factory default for the password code is 1111.

PROTECTION ACCESS PASSWORD

The protection system built into the controller blocks for 10 minutes the access to protected parameters after 5 consecutive frustrated attempts of guessing the correct password.

MASTER PASSWORD

The Master Password is intended for allowing the user to define a new password in the event of it being forgotten. The Master Password doesn't grant access to all parameters, only to the Password Change parameter PAS. After defining the new password, the protected parameters may be accessed (and modified) using this new password. The master password is made up by the last three digits of the serial number of the controller added to the number 9000. As an example, for the equipment with serial number 07154321, the master password is 9 3 2 1.

DETERMINATION OF PID PARAMETERS

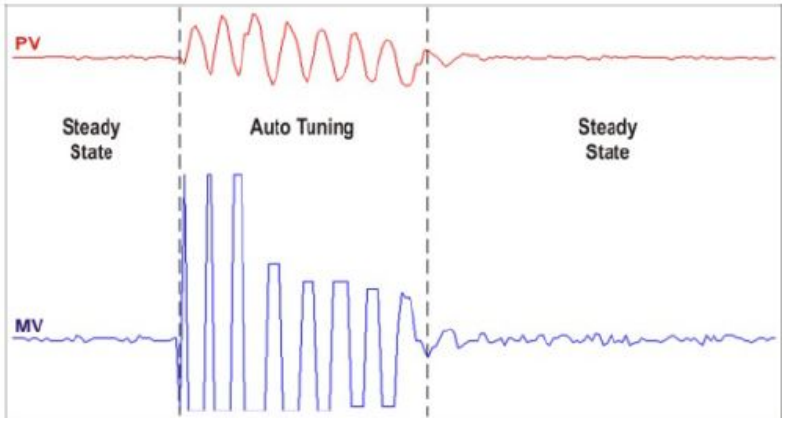
The determination (or tuning) of the PID control parameters in the controller can be carried out in an automatic way and auto-adaptative mode. The automatic tuning is always initiated under request of the operator, while the auto-adaptive tuning is initiated by the controller itself whenever the control performance becomes poor.

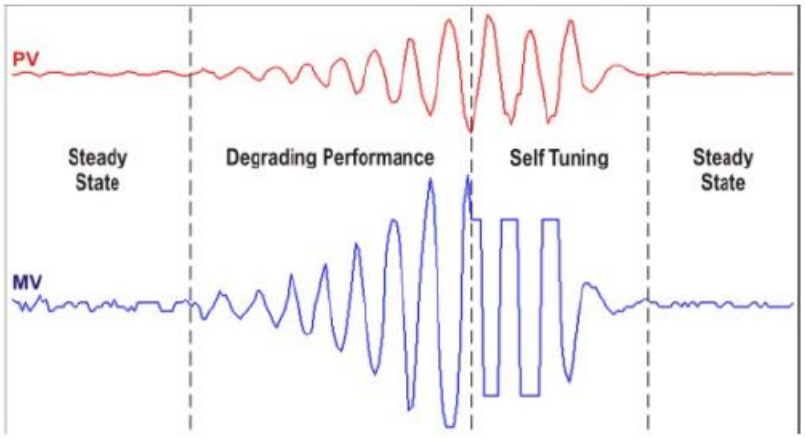
Automatic Tuning

In the beginning of the automatic tuning the controller has the same behavior of an ON/OFF controller, applying minimum and maximum performance to the process. Along the tuning process the controller's performance is refined until its conclusion, already under optimized PID control. It begins immediately after the selection of the options FAST, FULL, RSLF or TGHT, defined by the operator in the parameter ATUN.

Auto adaptative Tuning

Is initiated by the controller whenever the control performance is worse than the one found after the previous tuning. In order to activate the performance supervision and autoadaptative tuning, the parameter ATUN must be adjusted for SELF, RSLF or TGHT. The controller's behavior during the auto-adaptative tuning will depend on the worsening of the present performance. If the maladjustment is small, the tuning is practically imperceptible for the user. If the maladjustment is big, the auto-adaptive tuning is similar to the method of automatic tuning, applying minimum andmaximum performance to the process in ON/OFF control.





The operator main select through the ATUN parameter, the desired tuning type among the following options:

OFF

The controller does not carry through automatic tuning or auto-adaptative tuning. The PID parameters will not be automatically determined nor optimized by the controller.

FAST

The controller will the process automatic tuning one single time, returning to the OFF mode after finishing. The tuning in this mode is completed in less time, but not as precise as in the FULL mode.

FULL

The same as the FAST mode, but the tuning is more precise and slower, resulting in better performance of the P.I.D.

SELF

The performance of the process is monitored and the auto-adaptative tuning is automatically initiated by the controller whenever the performance poorer. After a tuning level, the controller starts collecting data from the process for determining the performance benchmark that will allow evaluate the need for future tunings. This phase is proportional to the process response time and is signaled by the flashing TUNE indication on the display. It is recommended not to turn the controller off neither change the SP during this
learning period. It is recommended not to turn the controller off neither change the SP during this learning period.

rSLF

Accomplishes the automatic tuning and returns into the SELF mode. Typically used to force an immediate automatic tuning of a controller that was operating in the SELF mode, returning to this mode at the end.

TGHT

Similar to the SELF mode, but in addition auto-adaptative tuning, it also executes the automatic tuning whenever the controller is set in RUN=YES or when the controller is turned on. Whenever the parameter ATUN is altered by the operator into a value different from OFF, an automatic tuning is immediately initiated by the controller (if the controller is not in RUN=YES, the tuning will begin when it passes into this condition). The accomplishment of this automatic tuning is essential for the correct
operation of the auto-adaptative tuning. The methods of automatic tuning and auto-adaptative tuning are appropriate for most of the industrial processes. However, there may be processes or even specific situations

where the methods are not capable to determine the controller's parameters in a satisfactory way, resulting in undesired oscillations or even taking the process to extreme conditions. The oscillations themselves imposed by the tuning methods may be intolerable for certain processes. These possible undesirable effects must be considered before beginning the controller's use, and preventive measures must be adopted in order to assure the integrity of the process and users. The AT signaling device will stay on during the tuning process.In the case of PWM or pulse output, the quality of tuning will also depend on the level time adjusted previously by the user.

PARAMETER	VERIFIED PROBLEM	SOLUTION
Proportional Band	Slow answer	Decrease
	Great oscillation	Increase
Rate of Integration	Slow answer	Increase
	Great oscillation	Decrease
Derivative Time	Slow answer or instability	Decrease
	Great oscillation	Increase

MAINTENANCE

PROBLEMS WITH THE CONTROLLER

Connection errors and inadequate programming are the most common errors found during the controller operation. A final revision may avoid loss of time and damages. The controller displays some messages to help the user identify

MESSAGE	DESCRIPTION OF THE PROBLEM
	Open input. No sensor o signal.
Err1 Err6	Connection and/or configuration errors. Check the wiring and the configuration.

Other error messages may indicate hardware problems requiring maintenance service.

CALIBRATION OF THE INPUT

All inputs are factory calibrated and recalibration should only be done by qualified personnel. If you are not familiar with these procedures do not attempt to calibrate this instrument. The calibration steps are

- Configure the input type to be calibrated.
- Enter in Calibration Level.
- At the input terminals, apply a signal corresponding to a value slightly above the lower input limit.
- Access the parameter inLC. Using the and keys, adjust the display reading such as to match the applied signal, then press the key
- At the input terminals, apply a signal corresponding to a value slightly below the upper input limit.
- Access the parameter inkC. Using the and keys, adjust the display reading such as to match the applied signal, then press the key.

- Return to the Operation level and check the calibration result.

Note
When checking the controller calibration with a Pt100 simulator, pay attention to the simulator minimum excitation current requirement, which may not be compatible with the 0.170 mA excitation current provided by the controller.

N1020 PARAMETER TABLE

OPERATING LEVEL	TUNING LEVEL	ALARMS LEVEL	CONFIGURATION LEVEL	CALIBRATION LEVEL
PV indication	atvn	Fv.a1	Type	Pass
Timer indication	pb	Fv.a2	fltr	(alib
SP	ir	Sp.a1	Dp.po	In.L
T1me	dt	Sp.a2	vnl t	In.k
Rate	(t	Bl.a1	0ffs	rstr
RvN	kyst	Bl.a2	Sp.ll	ovll
	ACt	Xy.a1	Sp.xl	ovkl
	sfst	Xy.a2	T1me	j
	0UT1	A1.t1	Tm.en	Pas
	0UT2	A2.t1	T.str	Prot
		A2.t2	T.e.(.0	Freq
		flsh	Rate	Snk
			rt.en	Snl
			RvN	
			rn.en	
			bavd	
			prty	
			Addr	

The PASS prompt precedes the parameters on the protected levels.

SPECIFICATIONS

- DIMENSIONS:25 x 48 x 105 mm (1/32 DIN)
- Panel Cutout:23 x 46 mm (+0.5 -0.0 mm)
- Approximate Weight:75 g

POWER SUPPLY

- 100 to 240 Vac/dc (±10 %), 50/60 Hz
- Maximum consumption: 5 VA

CONDITIONS ENVIRONMENTAL:

- Operation Temperature: 0 to 50 °C
- Relative Humidity: 80 % max.

INPUT

- T/C, Pt100 an voltage
- Input Resolution**:**32767 levels 15 bits
- Resolution of Display**:**12000 levels (from -1999 up to 9999)
- Rate of input reading**:**up to 55 per second
- Accuracy:Thermocouples
- J, K, T, E: 0.25 % of the *span* ±1 ºC
- Thermocouples N, R, S, B: 0.25 % of the span ±3 ºC
- Pt100: 0.2 % of the span mV: 0.1 %
- Input Impedance: Pt100 and thermocouples: > 10 MW
- Measurement of Pt100:3-wire type, (a=0.00385)

With compensation for cable length, excitation current of 0.170 mA

OUTPUT

- OUT1:Voltage pulse; 5 V / 25 mA
- OUT2:Relay SPST, 1.5 A / 240 Vac / 30 Vdc
- FRONT PANEL:P65, Polycarbonate (PC) UL94 V-2
- ENCLOSURE: IP30, ABS+PC UL94 V-0
- ELECTROMAGNETIC COMPATIBILITY:EN 61326-1:1997 and EN 61326-1/A1:1998
- EMISSION**:**CISPR11/EN55011
- IMMUNITY:EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5, EN61000-4-6, EN61000 4-8 and EN61000-4-11
- SAFETY: EN61010-1:1993 and EN61010-1/A2:1995 (UL file E300526)

USB INTERFACE 2.0, CDC CLASS (VIRTUAL COMMUNICATIONS PORT), USB CONECTOR: MINI B, MODBUS RTU PROTOCOL. SPECIFIC CONNECTIONS FOR TYPE FORK TERMINALS; PROGRAMMABLE LEVEL OF PWM DE 0.5 UP 100 SECONDS; STARTS UP OPERATION AFTER 3 SECONDS CONNECTED TO THE POWER SUPPLY;CERTIFICATIONS: CE, UKCA and UL

IDENTIFICATION

N1020	**– A**	**– B**	**– C**

- A: Output:
- PR: OUT1= Pulse / OUT2= Relay
- B: Digital Communication: 485
- Interface communication RS485
- C: Power Supply: 100~240 Vac/dc; 50~60 Hz

WARRANTY
Warranty conditions are available on our website **www.novusautomation.com/warranty**

Documents / Resources

	**NOVUS N1020 Temperature Controller** [pdf] Instruction Manual N1020, Temperature Controller, N1020 Temperature Controller, Controller

References

- **NOVUS Automation Inc. - Controllers, Thermostats, Data Loggers, Solid State Relays, Sensors, Transmitters, SCADA, Data Acquisition and Temperature Controllers**
- **Warranty - Company - NOVUS Automation Inc.**