# IRIS BLUE PID control – R02

Example of operation of a basic hydraulic system with automatic PID pressure control
-R02 10/05/2017
SW version: IB4.13x

Power supply 400V

Fuse

Tap

Tap

Tap

Pressure transducer
4–20mA
0÷10 Bar

Motor

Pump

Expansion tank

Foot check valve

Intake

Well

1
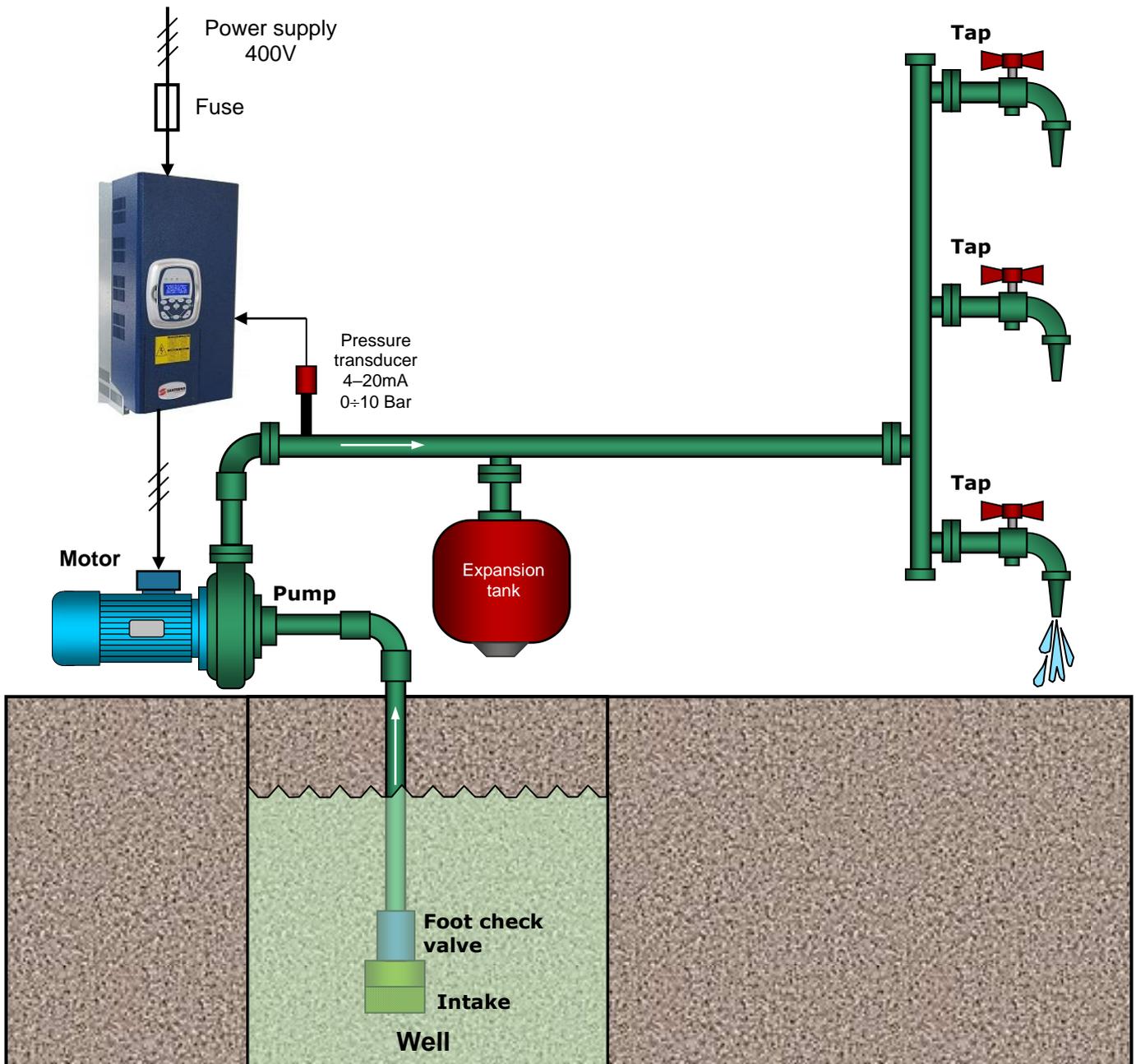
Electric diagram for passive pressure transducer 4 ÷ 20mA with Automatic/Manual switch.
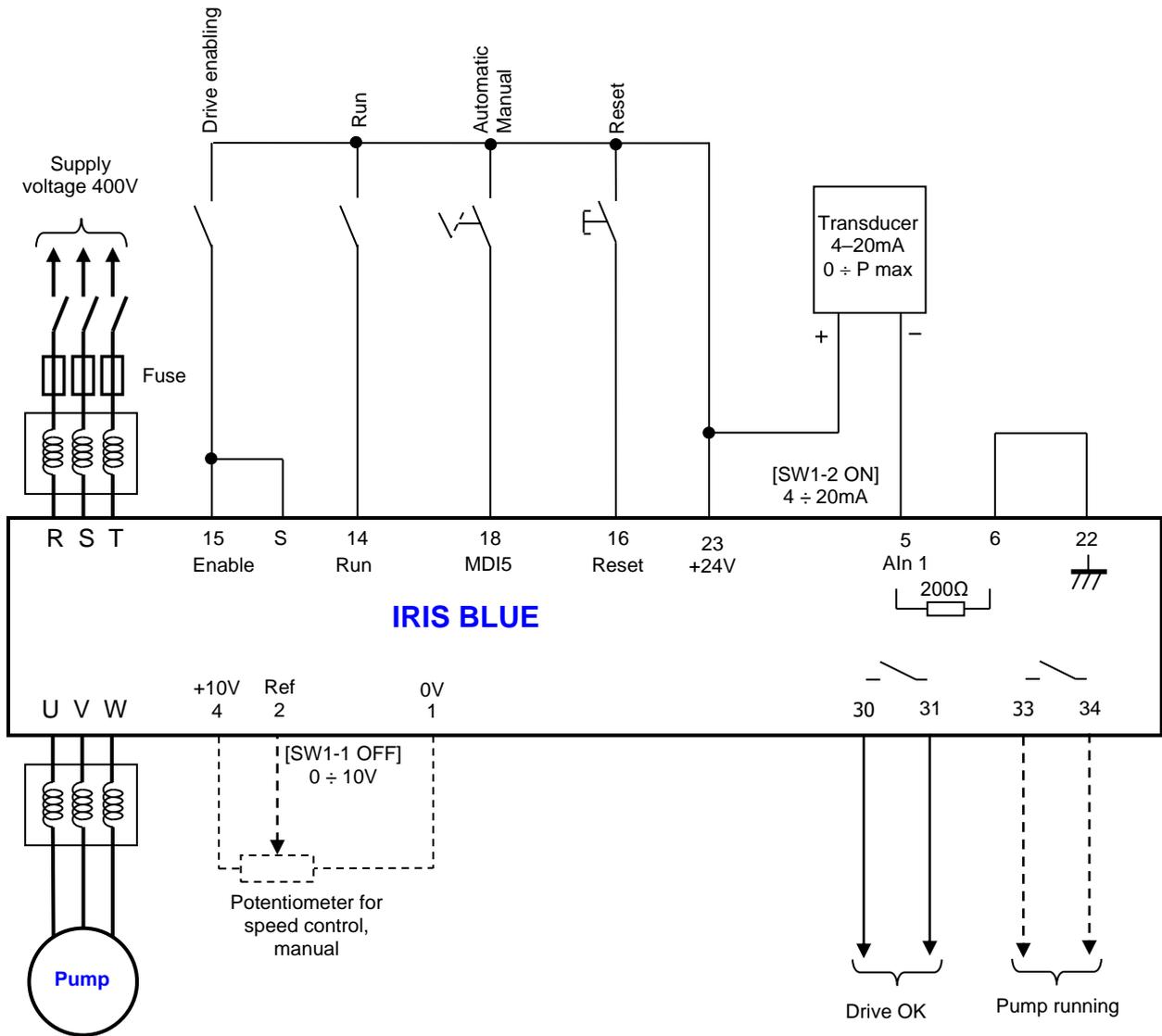
Figure 2

Electric diagram for active pressure transducer 4 ÷ 20mA with external supply.
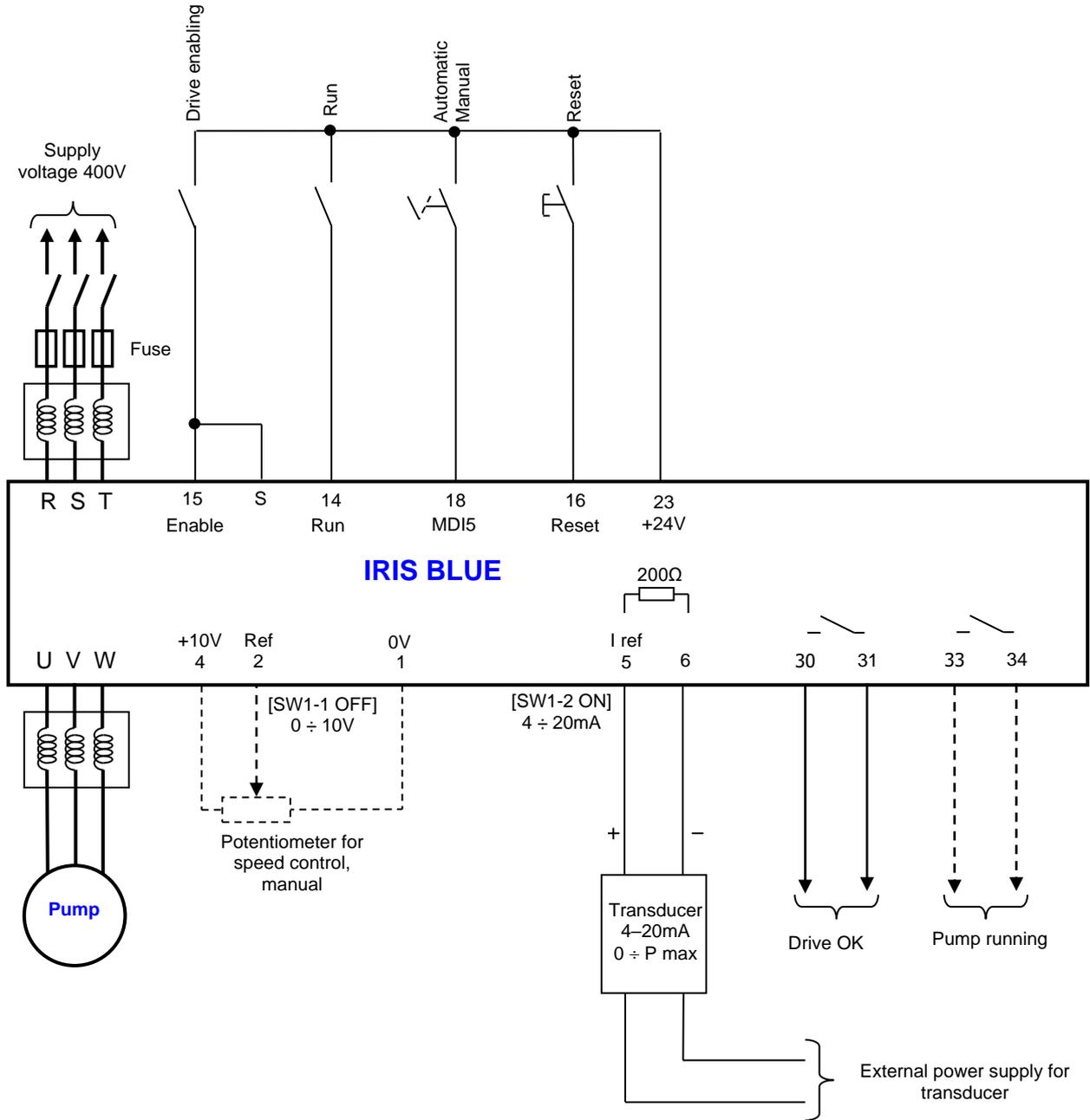
Figure 3

Preliminary programming

To perform the following programming procedure, the Drive must be in its default condition.
If you your device has been previously programmed, you will need to reset the internal programming
to the factory parameter values (Restore Default).

Language setting
The Drive is programmed by default with English as pre-set language, if you wish to choose a different one among the available ones, follow this procedure:
Select the Group "IDP", press "ENTER", then press "Arrow Up" and the text "PRODUCT" appears.
Press "ENTER" and "P263 Language → ENGLISH" appears.
Press "ENTER" and choose the desired language using the arrow keys "Up" or "Down", then confirm by pressing "ENTER".
Press the "MENU" key on the keypad twice to return to the main screen.

Programming the parameters of the "PAR" Group

Password and access level
P001 - Programming level   = Engineering   (max programming level)

Display/Keypad
P265 - First page   = Keypad   (page displayed at start-up)
P267 - PID unit of measure   = bar   (unit of measure selected by the user)

The following parameters represent the values that can be displayed directly on the keypad after the first activation of the Drive.

**P268d - Measure n 3 on Keypad page = M024: PID Fbk   (Third line displayed on "Measurements page")
**P268e - Measure n 4 on Keypad page = M023: PID Ref   (Fourth line displayed on "Measurements page")
**Parameters that can only be edited using the keypad.

Ramps
P009 - Acceleration ramp 1   = 3.00 s (Motor acceleration ramp)
P010 - Deceleration ramp 1   = 3.00 s (Motor deceleration ramp)
P018 - Initial acceleration time   = 1.00 s (Acceleration up to 60% of speed)
P019 - Final deceleration time   = 1.00 s (Deceleration below 60% of speed)
P020 - Initial/Final speed threshold of the ramp   = 60%   (Speed threshold for ramp change)
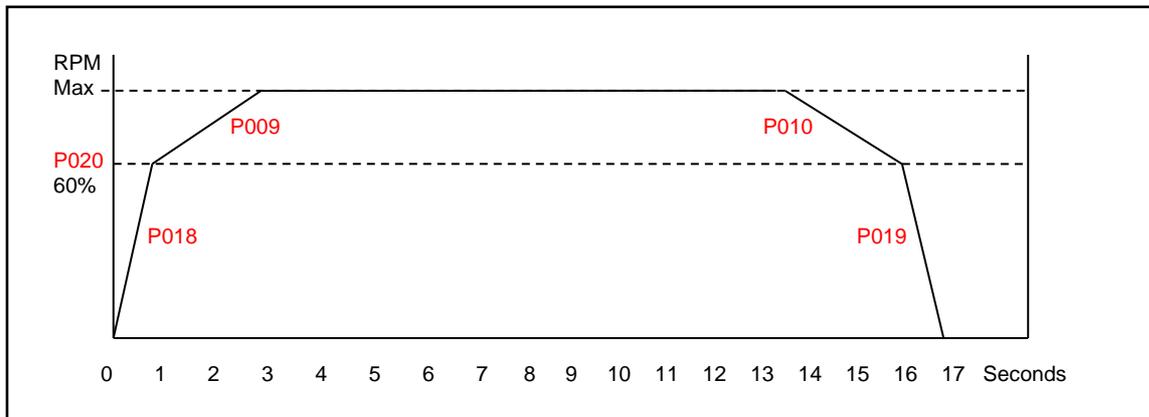
If the system is at risk of mechanic shock in the pipe lines (water hammer), the ramp time P010 must be extended as much as necessary to reduce or eliminate the shock.

Inputs for references
P055 - Input signal type AIN1   = 4-20 mA (Provides feedback input as
                                                                                    current input)
P059 - Filter on analog input AIN1   = 250 ms (Filter on feedback signal)

Motor configuration
C013 - Type of V curve on F   = Quadratic   (Energy saving curve)
C016 - Motor rated speed   = ….. rpm   (Enter the motor rpm value as on nameplate)
C017 - Motor rated power   = ….. kW   (Enter the motor power value as on nameplate)
C018 - Motor rated current   = ….. A   (Enter the motor current value as on nameplate)
C019 - Motor rated voltage   = ….. V   (Enter the motor voltage value as on nameplate)
C028 - Motor1min revolutions per minute   = ….. rpm
-Enter the minimum desired rpm value for the specific characteristics of the installed pump corresponding to the Pressure/flow operation point of the plant.
C029 - Motor max revolutions per minute   = ….. rpm   (Enter the maximum desired rpm value)

Control method
C144 - Reference 2 selection   = Disabled   (It disables the speed-reference secondary input)

Digital inputs
C171 - Digital input for PID disabling   = MDI5   (PID control is disabled by terminal input 18)

Thermal protection
C265 - Thermal protection mode for Motor1   = No derating

PID Configuration
C291 - PID operating mode   = Normal   (It enables PID control with opposite reaction to the feedback)

-Warning: Once C291 is modified, the Drive temporarily activates the alarm A067 "INPUT AIN1<4mA!.
Do not reset the alarm. Quit by pressing the "Menu" key twice and proceed with the programming ignoring the alarm condition. (The "Alarm" red light is on)

C285 - Selection of reference 1 PID   = Keypad   (Source of PID reference)
C288 - Selection of feedback   1 PID   = AIN1 [5 - 6]   (Source of PID feedback)

-Note, it is possible to reset the alarm by pressing the "RESET" key on the keypad, only if the transducer is connected and operating

Setting PID control and shutdown/automatic restart "Sleep"/"Wake Up" modes

The following group of parameters must be set according to the system specifications; the suggested programming reflects the typical requirements of a sample system.

"PAR" Group
PID Parameters
P237 - Min PID output   = …. %   (It sets the min working speed as a percentage)
This value must be set as a percentage of C028 and C029.
For example: if C028=2600RPM and C029=3000RPM calculate P237=(C028 * 100) /C029 = 86,6%.

P237a - Wake-up mode for PID   = ERR >P237b (Type of pump awakening based on error as %)
P237b - Wake-up level for PID   = +2.00%   (It establishes the error as a % that causes the pump to awaken)
P245 - Min reference accepted by PID   = ….   This is used if you need to limit the variation range of the
                                                                     minimum reference settable on the keypad, e.g. 30% (3 bar)
P246 - Max reference accepted by PID   = ….   This is used if you need to limit the variation range of the
                                                                     maximum reference settable on the keypad, e.g. 70% (7 bar)

P255 - PID Disable Delay for low PIDout   = 60 s   (Delay time after which, if the PID output reaches the
                                                                     set limit in P237, the motor automatically stops. "Sleep Mode".)
P255a - Reference for PID disable   = 0%
P255c - PID disable threshold with low ref. = Enter the same value in P237 plus 1%
P255d - PID disable threshold with high ref. = Enter the same value in P237 plus 1%
P257 - Gain for PID Measure Scaling   = 0,100   (Scale factor from the percent PID value)
For example: with P257=0.1, an indication of 10.00 Bar is obtained when the PID reference is 100%.

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Theory of operation

The diagram in the previous pages shows a pressure control system inside a manifold with feedback from a 4–20mA, 0–10 Bar probe.

The pressure set-point setting is done via the keypad. By changing the set-point it is possible to adjust the pressure from 0 up to the maximum transducer value, while keeping it constant according to the system needs.

In case the pressure settles at a value that exceeds the one set in the set-point, following a reduction in water demand, the Drive will adjust the pump to a minimum speed set in parameter P237 and, in case the Sleep mode is enabled, the pump will stop automatically, provided that the given condition lasts longer than the time set in parameter P255.

When a higher consumption is restored, the pump will start again as soon as the error reaches the value set in P237b, recovering the pressure level and maintaining it constant by means of the internal PID controller.

The system allows disabling the automatic PID control, by means of the selector at terminal 18, thus cancelling the reading of the transducer and turning the Drive into a manual speed control device, adjusted via a potentiometer.

Note:
The above-mentioned diagrams and parameter values represent a mere example of how the application can be used, and they may be modified according to the User requirements and the technical specifications of the system. Therefore, it is the installer's responsibility to ensure a correct implementation. Compliance with the current safety regulations and successful installation are responsibility of the installer; please refer to the application manual of the product.