EFD®
A NORDSON COMPANY

PicoDot™ Valve Controller
Operating Manual

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Introduction

You have selected a reliable, high quality PicoDot dispensing system from EFD, the world leader in fluid dispensing. The PicoDot dispensing system was designed specifically for industrial dispensing, and will provide you with years of trouble-free, productive service.

This User's Guide will help you maximize the usefulness of your PicoDot dispensing system.

Please spend a few minutes to become familiar with the controls and features. Follow our recommended testing procedures. Review the helpful information we have included, which is based on more than 30 years of industrial dispensing experience.

Most questions you will have are answered in this guide. However, if you need assistance, please do not hesitate to contact EFD or your authorized EFD distributor.

In Asia, call +86 (21) 3866 9006.

In Europe, call +44 (0) 1582 666334.

In the USA, call 800-556-3484 between 8:30 a.m. and 5:30 p.m. Eastern time.

In all other areas, call your authorized EFD distributor or +1-401-431-7000.

The EFD Pledge

Thank You!

You have just purchased the world's finest dispensing equipment.

I want you to know that all of us at EFD value your business and will do everything in our power to make you a satisfied customer.

If at any time you are not fully satisfied with our equipment or the support provided by your EFD Product Application Specialist, please contact me personally at 800-556-3484 (US), 401-431-7000 (outside US), or plambert@efd-inc.com.

I guarantee that we will resolve any problems to your satisfaction.

Thanks again for choosing EFD.

Peter Lambert

Peter Lambert, President

Contents

Safety Instructions

- The PicoDot valve controller is expressly designed for triggering PicoDot valve drivers or valves approved by EFD. It is essential to conform to the parameters and operating conditions prescribed in this operating manual.
- Turn off all power to the system before connecting or disconnecting any cables during installation or maintenance.
- The controller should be mounted so that the electrical interfaces are easily accessible and the control and display elements are easily visible.
- Do not connect products from other manufacturers or devices built inhouse to the valve controller.
- Repairs and modifications should only be performed by EFD.
- If the safety instructions are ignored, EFD will limit or exclude liability completely. This is valid for devices and accessories as well.

Equipment owners are responsible for ensuring that users:
- Receive safety training appropriate to their job function as directed by governing regulations and best industry practices.
- Are familiar with the equipment owner's safety and accident prevention policies and procedures.
- Receive equipment and task-specific training from another qualified individual.

These operating instructions are valid only for devices equipped with hardware release 0.1 and higher and with software release 1.1 and higher. You can verify the release versions in main menu 9/9 of the PicoDot valve controller.

1 Intended Use

The PicoDot valve controller is an electronic device for timed control of PicoDot valve drivers with rows of electric pulse-pause signals with a constant signal level and with variable (programmable) duration. These impulse sequences control the jetting process of the valves connected to the controller via the valve driver.

Variable parameters like pulse time, pause time, delay time and number of pulses are entered via an SD card. The programming sequence can be written on any PC text editor and saved on the SD card.

It is possible to change certain operating parameters of the program directly at the PicoDot valve controller via the MENUE and ESCAPE buttons at the front of the PicoDot valve controller.

The PicoDot valve controller allows calculating how much of the fluid is still in the container by subtracting the dispensed quantities from the initial quantity of the full container. The remaining quantity is shown in the display of the PicoDot valve controller and is available as an electrical signal at the interface

The PicoDot valve controller is designed as a plug-in module for installation in 19” racks. It is available with two or four independent channels. The control process (beginning of control impulse output) can be triggered for each channel independently via 10 digital input channels, via CAN bus or manually.

The PicoDot valve controller is designed to be operated in an AC network with voltages of 90 to 264 V and 47 to 63 Hz. Compliance with the operating conditions and operating instructions provided in this manual will ensure optimum performance and long service life.

1.1 Unpacking the Controller

After unpacking the controller, verify that the following components are present and confirm that the controller will be operated within the parameters specified on the serial number plate on the back of the controller.

1 PicoDot valve controller
1 Flexible cable, two-pin, length 2 m
1 SD-card and USB card reader
1 Operating Manual

2 PicoDot Valve Controller Setup

2.1 Setup Checklist

- Is the supply voltage between the range 90 and 264 V, and the frequency between 47 and 63 Hz?
- Is the PicoDot valve controller plugged into an outlet and switched on?
- Do you have the dispensing fluid? Is the PicoDot valve driver connected to the PicoDot valve controller? Is the interface of the PicoDot valve controller connected to a Master controller (e.g. PLC or industrial PC)? Is the production machine ready?
- Are the PicoDot valves connected to the PicoDot valve drivers?
- Are the external transmitters for digital input signals (manual or foot switch, light barriers, limit switch, keyboard, PLC, etc.) connected correctly and ready to operate?
- Has the right trigger voltage (internal voltage for switches; external voltage for operation with a PLC) been selected?
- Is the signal IN_STOP the right level of +24 V DC?
- Is the signal IN_FAULT_PLC the right level of +24 V DC?
- Are the emergency stop switches on the production machine easily accessible to operators?
- Is the best language selected?
- Have the right programs for the individual channels been loaded via an SD card (Download function under menu item 8/9)?
- Have the control programs for the individual channels (appropriate dispensing and pause times) been tested?
- Is the operating mode (under menu item 3/9: active/automatic, CAN, or manual operation) set correctly for all individual channels?

START: When all preconditions are fulfilled, you can start the dispensing process. Activate the corresponding input signals IN1 … IN10 (in automatic mode) or press the ENTER button (in manual mode). The green LED of the active channel flashes during the dispensing process.

2.2 Emergency Stop Function

The emergency stop function allows you to interrupt the dispensing process for individual channels. When triggering the emergency stop function for one channel/valve, a dispensing pulse that has already started will finish in order to produce a full drop before the dispensing cycle stops. The dispensing cycles of other channels are not affected.

The emergency stop function is triggered for each channel individually by interrupting the 24-V signal IN_STOP at Pin15. The emergency stop can be triggered as follows:

- In automatic or CAN operation, via the emergency stop button (e.g. break contact) near the valve.
- In manual operation, via the emergency stop button (break contact) near the dispensing device and additionally via the ESCAPE button at the PicoDot valve controller for the channel shown in the display.

Instead of applying a 24 V signal to the input IN_STOP, it is also possible to deactivate this input by setting a software switch. To do this you have to set the parameter “stop”= 0 in the control program, which deactivates the emergency stop function of this channel as long as “stop” is set to 0. With “stop” set to 0, the control unit can also be used for trials without a 24 V signal applied to Pin 15. To start a dispense cycle, apply a 24 V signal to input IN_FAULT_PLC. (Refer to section 4 for more information.)

2.3 Output Pulses

Every channel has its own area in program memory. A program for a dispensing cycle consists of 1 to 99 rows. The program rows and blocks for each individual channel can be written with a text editor program on a PC, saved as text files on an SD memory card and uploaded into the memory of the PicoDot valve controller. The start of a pulse-pause-block is triggered via input signals IN1 to IN10, or manually via the operating menu.

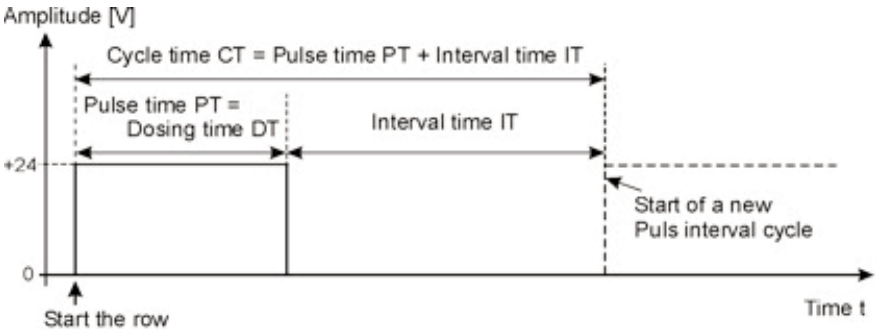
2.4 Pulse-Pause-Rows

A pulse-pause-row consists of 1 to 150 identical cycles (repeats). One cycle consists of a pulse time and a pause time.

The minimum dispensing time is 0.05 ms. With a pulse time of 0 ms it is possible that dispensing cycles are connected with a constant or variable delay time. To do this you have to enter a corresponding numerical value or a “v” in the control program under the appropriate row in the field “pause time”.

The pause time between two dispensing pulses should be at least 0.12 ms. With a pause time of 0 ms it is possible to program a permanent signal (permanent dispensing). This way you can dose a constant row or bead.

The general sequence of a pulse-pause-row is shown below. The variables for such a pulse-pause-row are pulse time, pause time and number of pulses. The pulse height has a constant value of +24 VDC; it is not variable.



You can activate a single row or several rows connected as a block.
General Pulse Diagram for one Pulse-Pause-Row. (One row consists of 1 to 150 pulse-pause cycles).

It is possible to save up to 99 different pulse-pause-rows per channel in the program memory of the PicoDot valve controller. Each row can be triggered via a digital input signal IN1 to IN10 or by linking it to a preceding row.

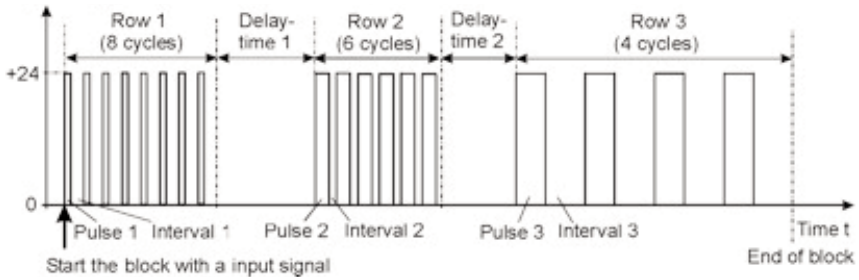
2.5 Pulse-Pause Blocks

A pulse-pause-block is a block with 2 to 99 linked pulse-pause-rows. It is possible to add a delay time of 0 to 10 s (in 1ms steps) between linked rows.

Pulse-pause blocks can be triggered by IN1 … IN10 or manually via the menu. In the case of linked rows, the end of a row automatically triggers the next row with-out an additional trigger signal. It is also possible to program closed loops.

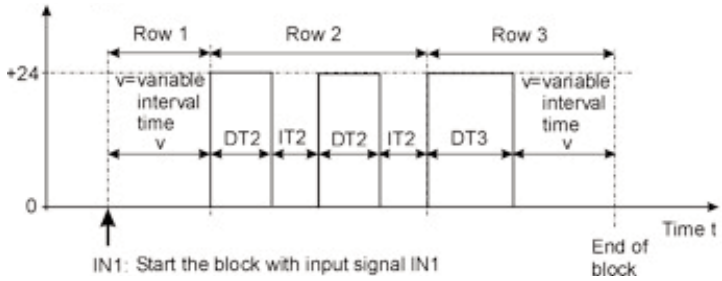
Binary signals (start signals) can be created via push button, manual switch, foot or limit switch, PLC, industrial PC, etc. The binary input triggering the start of a row has to be defined in the row program. The following pulse diagram shows an example of a pulse-pause block consisting of 3 linked rows.

EXAMPLE 1: Pulse pause-block with constant pause times.



The block shown in example 1 consists of 3 rows having different constant pulse and pause times as well as a different number of pulse cycles per row. Row 1 is triggered via input signal IN1 … IN10. The linked rows 2 and 3 are started after completion of the preceding row. A delay time was added between row 1 and 2 as well as between row 2 and 3. For the delay time you can define a value between 0 and 10s.

EXAMPLE 2: Pulse-pause block with constant and variable pause times.



v = f(U_{Ean})
U_{Ean} = 0…10 V
U_{Ean}: analog input voltage; program controlled allocation:
0 V = 0 ms
10 V = delay time
delay time: programmable between 0 and 10,000 ms

Row 1: dispensing time = 0, pause time = v (variable), delay time = 0
Row 2: dispensing time = DZ2 (constant), pause time = PZ2 (constant), delay time = 0
Row 3: dispensing time = DZ3 (constant), pause time = v (variable), delay time = 0
The block shown in example 2 consists of 3 rows having both variable and constant pause times. A pause of variable length is realized in row 1 (no pulse).

Row 2 consists of two pulses and two pauses, each having a constant length. Row 3 consists of one pulse of constant length as well as one variable pause time. The example block 2 is triggered by a signal on input IN1. No delay times have been added between the individual rows.

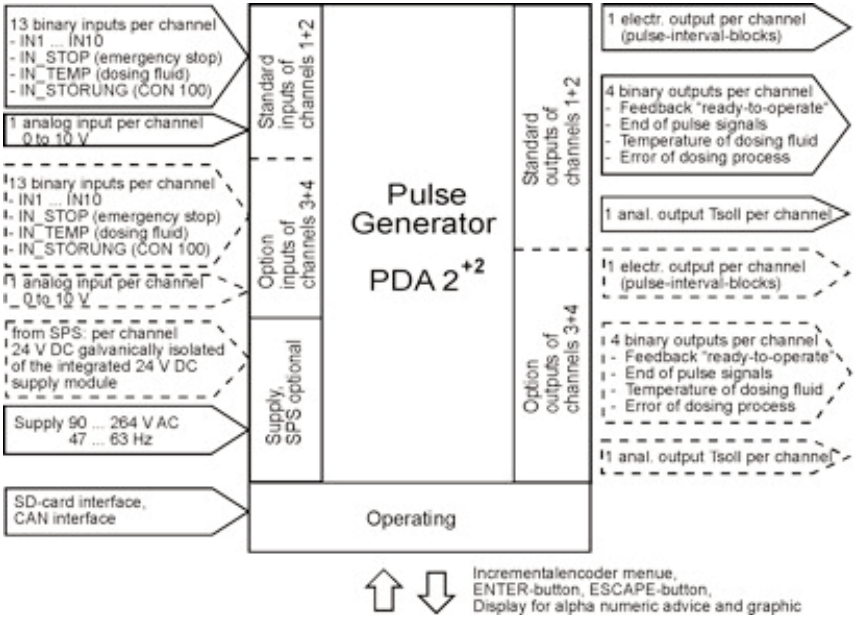
Parameter	Description
Container, full [0 to 9999g]	Initial fluid quantity in the full container (this quantity of a full container can be used for dispensing).
Max. remaining quantity [0 to 9999g]	A signal appears as soon as the maximum remaining quantity is reached in order to start any necessary steps in time (e.g. container exchange). (Remaining quantity = complete container quantity minus current consumption).
Setting range [0 to 100% o rv = complete range]	Setting of variation possibility at the control unit (in percent of dispensing time, pause time, number of pulses); the setting range v allows the entire range of values for the variation.
Temperature [0 to 100°C]	Temperature setpoint of the fluid in the valve; this value is valid for all dispensing processes of this channel.
Stop 0 = off; 1 = on	Software switch for emergency stop function; emergency stop is triggered when the applied 24 V signal drops to 0V.
Delay time [0 to 10000 ms, resolution 10 bit]*	Maximum value of a variable pause time; the pause time is changed proportionally to the analog input voltage 0 to 10 V within the range 0 to delay time (0 V – 0 ms; 10 V – delay time).
Row [1 to 99]	Ascending numbering of the program rows; 1 to 99 rows can be saved for each channel.
Dispensing time [0 or 0.05 ms to 9999.99 ms]	Duration of a dispensing pulse – during this time fluid is dispensed. 0.05 ms is the minimum dispensing time for the PicoDot valves; 0 ms if the dispensing process starts with a pause.
Pause time [v, 0 or 0.12 ms to 9999.99 ms]	Interval between two dispensing pulses (min. 0.12 ms); during this time no fluid is dispensed; 0 ms to connect pulses in series as permanent signal; in case of variable pause time v an analog input signal controls the pause between 0 ms and delay time.
Number of pulses [1 to 999]	Number of (identical) dispensing pulses in one row; one pulse consists of a dispensing time and a pause time.
IN [IN=1 to 10, IN=0]	Input signal to start a row; signal transmitters can be push button, switch, light barrier, PLC; IN = 0: row cannot be triggered via input signal, triggering only possible when linked as V-row to another row.
V-row [0 to 99]	A row is linked to a V-row (following row); a delay time can be added between the linked rows; all existing rows 1 to 99 can be linked with each other in any sequence; row 0 means no linkage (i.e. end of row).
Delay time [0 to 10000 ms]	Delay time between two linked rows (e.g. time required to transport a product to a new position).
Number of blocks [1 to 999]	Number of cycles of one row (or of one block); for rows (blocks) that can be triggered the number of blocks has to be at least 1. Note: If a number of connected rows will be run several times, the number of runs has to be defined in the start row under “number of blocks.”
Quantity [0 to 9999 mg]	Consumed quantity of fluid per row; this information is used to calculate the fluid consumption (number of rows multiplied by quantity/row). The quantity per row has to be determined through trials.
Ext. permanent signal 0 = standard regime 1 = special regime	0 = no external permanent signal, i.e. the dispensing cycle works with the standard process (start of the dispensing cycles via input IN1 to IN10); 1 = external permanent signal active, i.e. as long as the external signal is active, the dispensing program is continuously repeated in a closed loop and is stopped immediately upon loss of the input signal; a started dosing pulse will be completed to ensure that a complete drop is dispensed.

*Due to the circuit design, only approx. 800 of the possible 2^{10} = 1024 single steps are actually used.

2.7 Authorizations and Certifications

- The PicoDot valve controller can be plugged into standard 110V/220V outlets and is in compliance with EMC Guideline 89/336/EEC.
- The switching power supply used in the PicoDot valve controller is designed for supply voltage of 90 to 264 V with 47 to 63 Hz.
- The device is CE-certified and has the classification “protective insulation”.
- The climatic test was effected according to the environmental testing procedure IEC 68.

2.8 Design and Interfaces of the PicoDot valve controller

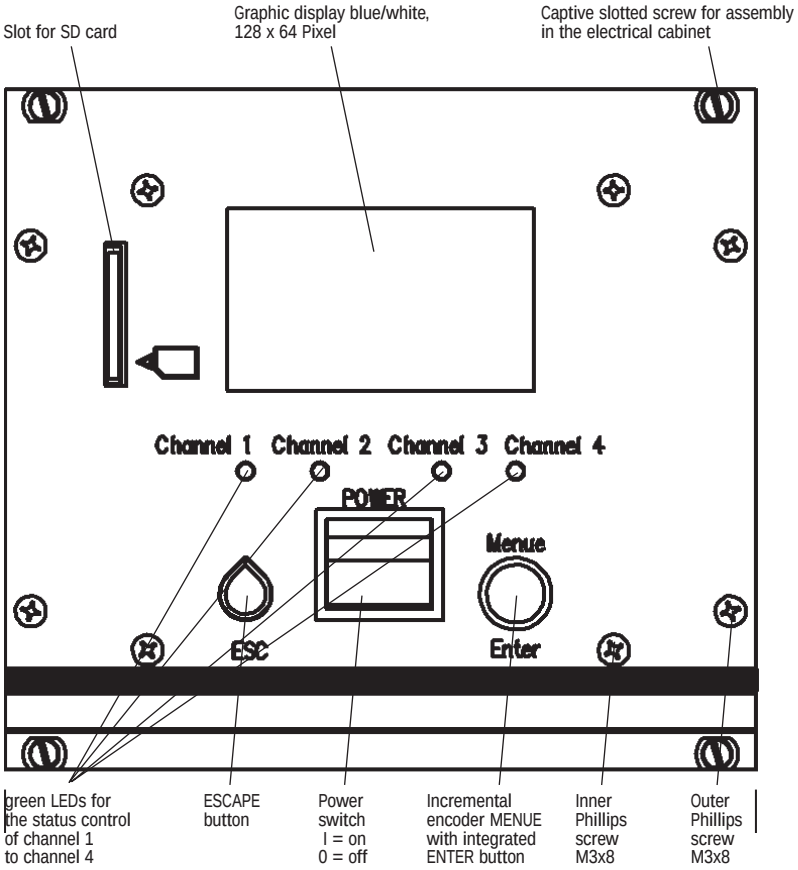


The PicoDot valve controller includes the interfaces shown in the above diagram. When triggering via a PLC we recommend electrically isolating the binary output signals from the voltage of the valve controller and supplying them via the external PLC voltage.

The PicoDot valve controller is a microprocessor-based unit. The controller parameters can be programmed via an ASCII text file and an SD card. It is also possible to set the parameters within preset limits via an incremental encoder and two keys at the front panel. The display indicates the current values.

2.8.1 Front Panel View

Dimensions (W x H): approx. 142 mm x 129 mm (5.6" x 5.08")

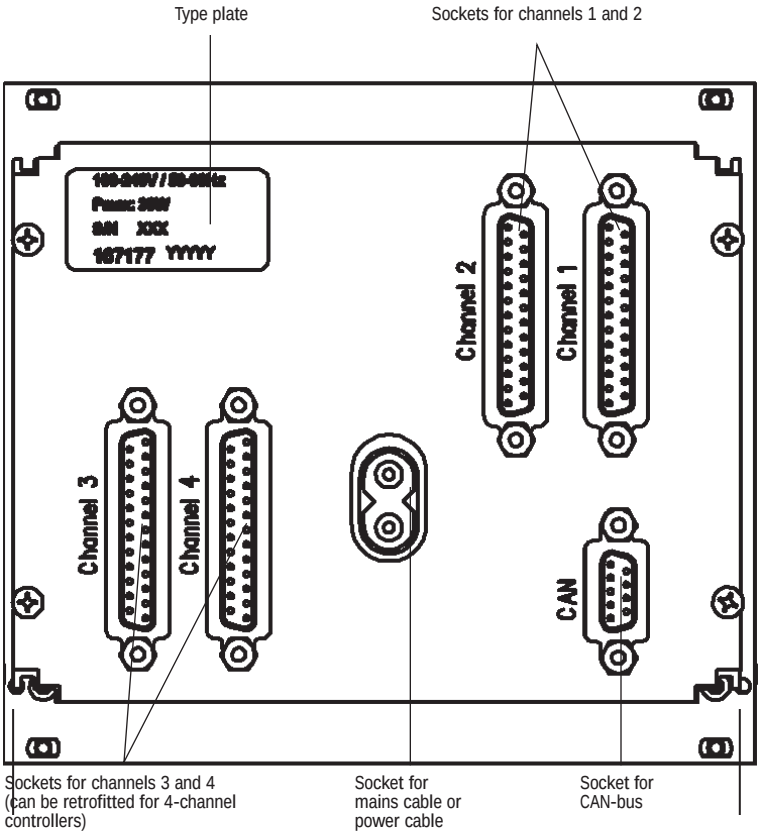


The front plate is mounted on the case by means of the four outer Phillips screws.
The front printed board is mounted by means of the four inner Phillips screws.

Control	Function
Incremental encoder MENUE	Selection of a menu item in the operating program or of a numerical value for the parameter adjustment.
ENTER button	Change to the subordinated level within the current menu item; confirmation of settings.
ESCAPE button	Return to the higher level in the operating program.

2.8.2 Back View with Electrical Interfaces

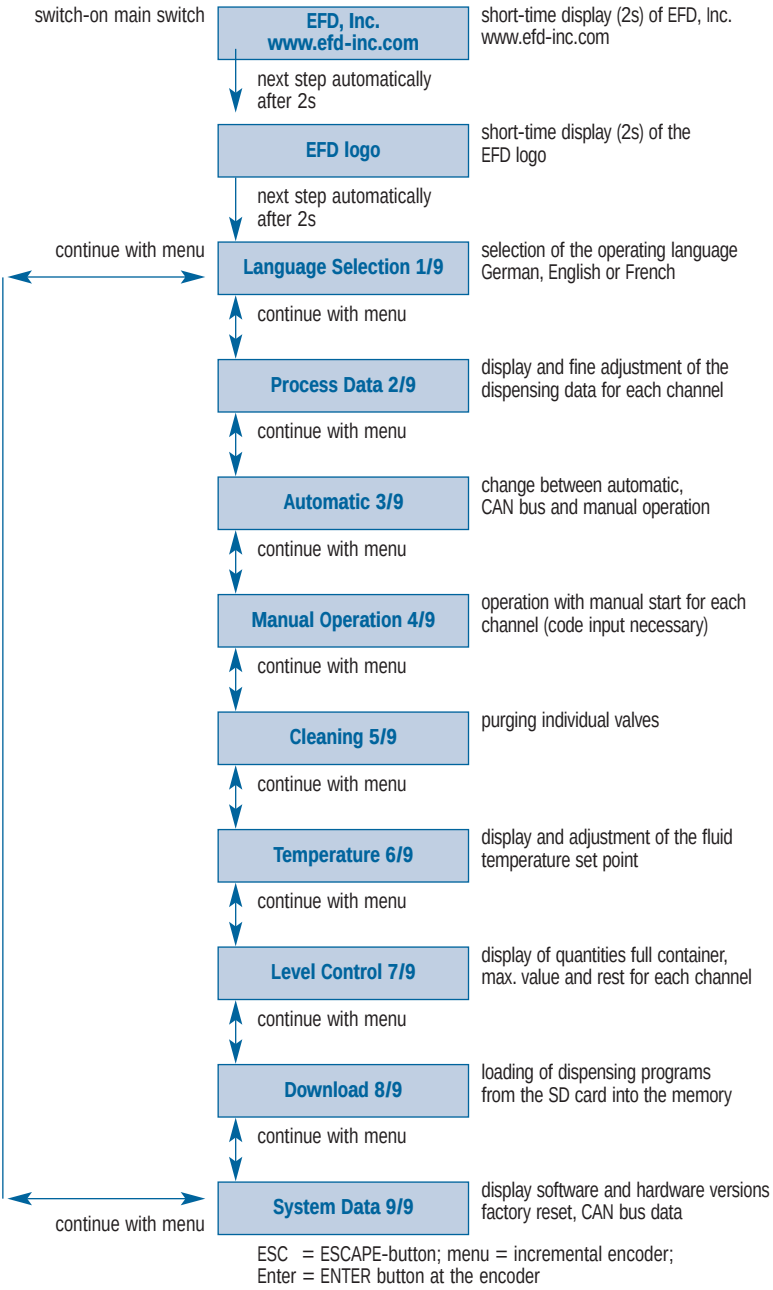
Dimensions: W x H = Approx. 138 x 106 mm (5.43" x 4.17")



Connection	Remark
Power supply	Two-pin power supply, socket for mains cable.
Channel 1 to 4	One 25-pin sub-d-socket per channel to connect the signals necessary for the control of a dispensing process. Channels 1 and 2 are standard; channels 3 and 4 can be added optionally. The slots for sockets 3 and 4 are already provided and covered with an adhesive label.
CAN-Bus	9-pin sub-d-socket for optional connection of a parent control unit with CAN-bus-communication.

3 Program Structure and Operating Menu

3.1 Main Menu of the PicoDot Valve Controller



ESC = ESCAPE-button; menu = incremental encoder;
Enter = ENTER button at the encoder

3.2 Operating Menu of the PicoDot Valve Controller

The operating structure of the PICODOT VALVE CONTROLLER is based on a very simple operating philosophy. All operating steps are started from the main menu. Two pushbuttons and a dial knob (incremental encoder) are used as controls. The ENTER key is combined with the MENUE encoder dial knob. The ESCAPE button is a separate button.

All selected parameters are highlighted in the display.

The controls have the following functions.

ENTER button at the MENUE knob: Activates a parameter – the active value flashes.

MENUE dial knob: Modifies the flashing parameter (numerical values, menu items). Turn clockwise to increase value; turn counter-clockwise to decrease value.

ENTER button: Confirms a flashing value and continues with the next value to be modified.

ESCAPE button: Returns to the higher menu level.

Operation: After switching on the controller with the power switch, the following items will be displayed on the screen:

- EFD, Inc.
- www.efd-inc.com
- The EFD logo
- The main menu item Language Selection 1/9 (see next window).

Chose between English, German and French for display of all menus and parameters.

NOTE: the active menu item or parameter flashes.

Language	1/9
Deutsch English Francais	

- Activate the language selection by pushing the Enter button.
- Select a language by turning the MENUE knob.
- Confirm the selected language by pushing the Enter button (the selected language will be displayed).

Process Data	2/9
Valve 1 2 (3) (4)	

- Activate the language selection by pushing the Enter button.
- Select the valve by turning the MENUE knob.
- Confirm the selected valve by pushing the Enter button (the process data for the active valve will be displayed).

Process Data Valve 1, Row 1	1/4
Dosage Time: 0.05 ms Pause Time: 0.1 ms (Delay Time: 100 ms*)	

- Select Program 1 by pushing the ENTER button.
- Set the program by turning the MENUE knob.
- Confirm the program by pushing the ENTER button and continue with dosage time.
- Set dosage time by pressing the MENUE knob (shorter dosage time = smaller dots, longer dosage time = larger dots).
- Confirm dosage time by pressing the Enter button and continue with pause time.
- Set pause time by turning the MENUE knob.
- Confirm pause time pushing the ENTER button and go back to menu 1/4.

Process Data Valve 1, Row 1	2/4
Puls Count: 5 Activation: IN1	

- Select the number of pulses (cycles for one trigger signal) by pushing the ENTER button.
- Set the number of pulses by turning the MENUE knob.
- Confirm number of pulses by pushing the ENTER button and return to menu 2/4 (Activation: IN1 is only displayed. It is not possible to change the control signal here).

Process Data Valve 1, Row 1	3/4
Linkage: Z0 Delay: 0.000s Block: 1	

- Linkage, Delay and Block are only displayed; no adjustment is possible.
- Turn the MENUE knob to change the program row.
- Push the ESCAPE button to go to menu 2/9 (change valve).

Process Data Valve 1, Row 1	4/4
Dispensing Value: 100.00 mg Ext.Puls: 0 Stop:	

- Dispensing Value, External Pulse and Stop are only displayed; no adjustment is possible.
- Turn the MENUE knob to change the program row.
- Push the ESCAPE button to go to menu 2/9 (change valve).

Process Data Valve 1, Row 1	1/4
Dispensing Value: 100.00 mg Ext.Puls: 0 Stop:	

- Change program row (here row 2) by pushing the ENTER button and turning the MENUE knob.
- Select dosage time and pause time by pushing the ENTER button.
- Set times by turning the MENUE knob.
- Confirm times by pushing the ENTER button.
- Advance to menu 2/4 etc. by turning the MENUE knob.

Automatic Mode	3/9
Valve 1: active Valve 2: active Valve 3: Valve 4: Valve 4:	

- Activate active by pushing the ENTER button.
- Select active, CAN or manual operation by turning the MENUE knob.
- Confirm new setting by pushing the ENTER button and advance to the next valve or to menu 3/9.
- Go to menu “Manual operation 4/9” by turning the MENUE knob.
- In the 4-channel PicoDot valve controller, valves 3 and 4 are also shown as active.

Manual Operation	4/9
Enter Code	

- To the input field for 6-digit code via Enter.
- Enter the code numeral by numeral via Menu and Enter. If code is wrong, branching is not possible via Enter, back with Escape or back to code input. If code is correct, select valve via Enter (factory setting: all spaces empty = press Enter every time).
- In case of manual operation the interface is deactivated automatically! It has to be activated again (active or CAN)!

Manual Operation	4/9
Valve 1 2 (3) (4)	

- Go to valve 1 by pushing the ENTER button.
- Select valve by turning the MENUE knob.
- Confirm valve by pushing the ENTER button and go to menu “Manual Operation 1/4”.

Manual Operation Valve 1, Row 1	1/5
Start	

- Select the start row via by pushing the ENTER button and turning the MENUE knob.
- Confirm the start row by pushing the ENTER button with Enter and go to start.
- Push the ENTER button to manually trigger a dispensing cycle for the active valve with the process parameters of the activated row.
- Go to menu “Manual Operation 1/5” by pushing the ENTER button.
- Go to menu “Manual Operation 2/5” by turning the MENUE knob.

Manual Operation Valve 1, Row 1	2/5
Dosage Time: 0.05 ms Pause Time: 0.10 ms	

- Set program, row, dosage time and pause time by turning the MENUE knob and confirm by pressing the ENTER button.
- Adjust and confirm, after adjustment of pause time the cursor will go to 2/5.
- Go to menu “Manual Operation 3/5” by turning the MENUE knob.

Manual Operation Valve 1, Row 1	3/5
Puls Count: 5 Activation: IN1	

- Activate number of pulses by pushing the ENTER button and turning the MENUE knob.
- Change number of pulses by turning the MENUE knob.
- Confirm the number of pulses by pushing the ENTER button and back to 3/5.
- Go on to menu “Manual Operation 4/5” by turning the MENUE knob (the controlling input signal IN1…IN10 can only be adjusted via the SD card).

Manual Operation Valve 1, Row 1	4/5
Linkage: Z0 Delay: 0.000s Block Count: 1	

- Display the linked next program row (Z0 = without linkage) and the delay time (example zero) between the linked program row and number of blocks.
- Go to menu “Manual Operation 4/9” by pushing the ESCAPE button.

Manual Operation Valve 1, Row 1	5/5
Dispensing Value: 100.00 mg Ext. Puls: 0 Stop: 1	

- Display the dispensed mass of the row, external duration signal status and emergency stop status.
- Go to menu “Manual Operation 4/9” by pushing the ESCAPE button.

Cleaning	5/9
Valve 1 2 (3) (4:	

- Select the valve to be cleaned by pushing the ENTER button and turning the MENUE knob.
- Confirm valve selection by pushing the ENTER button.
- Change to cleaning menu 1/1 or temperature menu 6/9 by turning the MENUE knob.

Cleaning Valve 1	1/1
Closed	

Activate Closed by pushing the ENTER button (Closed will flash).

Cleaning Valve 1	1/1
Open	

Push the ENTER button to open the valve. The display will change to open and the valve will remain open as long as the Enter button is pressed.
Cleaning can be repeated as often as necessary by pressing the ENTER button.
The green valve LED flashes while the valve is open.
To clean another valve, press the ESCAPE button two times to return to menu "Cleaning 5/9".

Temperature	6/9
Valve 1 2 (3) (4)	

- Select a valve by pushing the ENTER button and turning the MENUE knob to display or set the target fluid temperature.
- Confirm valve selection by pushing the ENTER button and go to menu "Temperature 1/1".

Temperature Valve 1	1/1
Act. Value: 35.0°C Setpoint: 35.0°C	

- Act. value shows the temperature setpoint entered last.
- Activate the setpoint by pushing the ENTER button.
- Change the setpoint by turning the MENUE knob.
- Confirm the new setpoint by pressing the ENTER button (Act. Value and setpoint show the new temperature being set).
- Go back to menu "Temperature 6/9" by pressing the ESCAPE button.
- Go to the menu "Level Check 1/1" by turning the MENUE knob.

Level Check	7/9
Valve 1 2 (3) (4)	

- Select valve by pushing the ENTER button and turning the MENUE knob.
- Confirm valve selection by pushing the ENTER button.
- Go to menu "Level Check 2/2" by turning the MENUE knob Go to menu "Level Check 1/2" by turning the MENUE knob.

Level Check	1/2
Container: 1000.00 g Limit: 50.00 g Remainder: 900.00 g	

Display Only
- Initial full container fluid quantity and fluid limit value can only be entered via SD card.
  The remaining fluid quantity in the container is calculated as difference between the full container and the dispensed quantity.
- Go to menu "Level Check 2/2" by turning the MENUE knob.

Level Check Valve 1	2/2
Limit reached Change Container? execute	

- Replace an empty container with a full one of the same size.
- Confirm container exchange by pushing the ENTER button 2 times.
- Reset the remaining fluid weight to the full container weight and change to menu "Level Check 1/2" with updated display. If the quantity of the new container is different from previous container the new container fluid weight needs to be set via the SD card.
- Go to menu "Level Check 7/9".

Level Check Valve 1	1/1
Max value achieved Change Container? execute	

*Displayed when the remaining fluid has reached the limit (according to the calculated dispensed fluid quantity.
- Check container & decide whether to replace the container or continue dispensing.
- Activate execute container replacement by pushing the ENTER button.
- Confirm by pushing the ENTER button (remaining quantity is added to the quantity of the full container) or
- Continue dispensing from the original container until the container is really empty.

Level Check Valve 1	1/1
Container empty Change Container? execute	

**Displayed when the container is really empty (according to the calculation).
- Check the container and decide whether to replace or continue.
- Activate execute container replacement by pushing ENTER.
- Confirm by pushing the ENTER button (remaining quantity is added to the quantity of the full container) or
- Continue dispensing with the original container without container replacement.
- Continue dispensing until the container is really empty.

* The display “maximum value reached” is indicated after reaching the calculated maximum remaining value of the fluid in the container (full container less number of rows multiplied by quantity per row. This calculated value can differ considerably from the quantity actually remaining in the container, since the dispensing quantity per row has to be determined empirically. Check the remaining quantity and decide whether to replace the container or continue dispensing. The dispensing process will continue while this warning message is displayed. The controlling PLC receives the status signal OUT_FAULT_PLC from the control unit.

Container Replacement: Stop the dispensing process by pushing the ENTER button (the actual row is still carried out entirely); replace the container, confirm container replacement by pushing the ENTER button; restart the dispensing process.

** If the dispensing process is continued without replacing the container after the message “max. value achieved”, the information “container empty” will be displayed if the calculated remaining value = zero.

The dispensing process is not interrupted automatically. The information is not signalled again to the PLC. Be sure to check the remaining quantity and replace the container in time.

Download	8/9
Execute	

- This menu allows you to download program data from an SD card into the PicoDot valve controller.
- Download is possible if no dispensing process is active and the SD card with the program to be loaded is inserted in the SD slot.
- Download the program by pushing the ENTER button. A data are downloaded message will be displayed.
- If the download was not successful, an init error message will be displayed. If this happens, reinsert the SD-card and repeat the procedure (Refer to Appendix A-2).

Download	8/9
Download successful	

- Errors in the value range and data structure are indicated on the display in plain text. (Refer to Appendix A-2).
- If the download was successful, a download successful message will be displayed.
- Go to menu “System Data 9/9” by turning the MENUE knob

System Data	9/9
Show	

- Displays the software and hardware releases, execution of a factory reset, and changes to the CAN-bus parameter address and baud rate.
- Go to menu “System Data 1/3” by pushing the ENTER button.

System Data Revisions Base	1/4
Software release: 1.1 Hardware release: 1.1	

- Displays the software and hardware releases of the printed circuit board for channels 1 and 2.
- Refer to Chapter “Safety Instructions” to verify that it covers the software and hardware version of your PicoDot valve controller.
- Go to menu “System Data 2/4” by turning the MENUE knob.

System Data Revisions Ext.	2/4
Software release: 1.1 Hardware release: 1.1	

Displays the software and hardware releases of the printed circuit boards for channels 3 and 4. If channels 3 and 4 are not installed or the software release is lower than 1.1 the string “-” will be displayed.
Go to system menu 3/4 by turning the MENUE knob.

System Data Factory Reset	3/4
Enter Code	

Factory Reset sets all variables back to factory settings.
Enter the password & confirm by pushing the ENTER button & turning the MENUE knob.
If a code wrong message appears, press the ESCAPE button and reenter the password.
When the password is entered correctly, start is displayed.
Start the factory reset by pressing the ENTER key. During the reset process, active and successful messages will be displayed.
Go to menu 3/4 by pressing the ESCAPE button and then to menu 4/4 by turning the MENUE knob.

System Data CAN	4/4
Address: 63 Baud rate: 1.1	

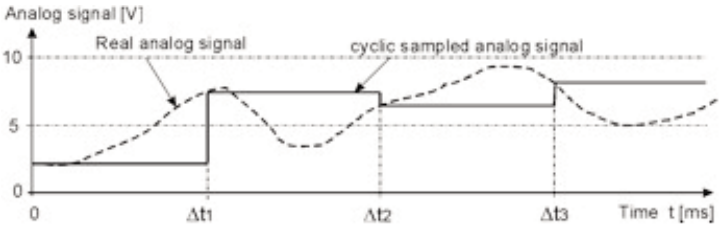
- Activate, adjust and confirm the CAN parameters by turning the MENUE knob and pushing the ENTER button.
- Go to menu 1/4 by turning the MENUE knob.
- Go to menu “System Data 9/9” by pressing the ESCAPE button.
- Go to menu “Language Selection 1/9” by turning the MENUE knob.

3.3 PicoDot Valve Controller Control Programs

3.3.1 Program cycles

1. The input signals are polled within short but not completely constant intervals. In the worst case there may be a delay of up to 0.300 ms between activating an input signal IN1 to IN10 and the actual start of the dispensing process.

2. The analog signal to control variable pauses is polled as quickly as possible but at least every 10 ms. Between to polling interval, the input values remain constant (see drawing).



Real and cyclic interrogated analog signal (interrogation cycle $\Delta t \leq 10$ ms)

3.3.2 Program Files

Control programs for the PicoDot valve controller are written on a PC with a text editor, saved as .txt files on an SD memory card, and uploaded to the controller.

The following examples illustrate the structure of the programs:

- General data block for specification of the PicoDot valve controller (once for each program)
- Specifications for each channel (once per channel)
- Specifications regarding rows and blocks (for each row or each block)

One program section for one channel can consist of 1 to 99 rows.

3.3.3 Factory Settings

Language	German
Adjustment range	v (full variation possibility for the manual input)
Row 1	IN1; number of pulses 1; number of blocks 1
Stop	0 (emergency stop deactivated, i.e. it is possible to dispense without the 24V signal at the emergency stop input) NOTE: At IN_FAULT _PLC (PIN 17) it necessary to have 24 V
Code	□□□□□□ (6 times spaces in the control program)
CAN-baud rate	125 kBit/s
CAN-address	63
All other parameters	0

3.4 Characteristics of a Control Program

The structure of the control program (TXT file) is given as a sample in the following examples. NOTE: German parameter names must remain in the program text for the controller to interpret the program properly.

- Each control program begins with a header that contains the device name, the base card release and the program name.

- The PicoDot valve controller automatically tests the compatibility between the software and the control program. Control programs are backward-compatible to software version 0.7. If you use a control program with a higher software release, the controller will accept it only if the value behind the decimal is higher than the base version.

For example, a device with software release 1.0 will accept control programs with the string [SW Revision] 1.1. It would not accept a control program with a software revision with a higher value before the decimal. For example a release with string [SW Revision] 2.0 would not be accepted.

- The character string between [Description] and [Data] must not include "[ ]"

- Parameter names like "Code", "Ventil-Nr.", "Delay-Time", "ext.Dauers.") should not include any spaces and must be in the correct position.

- All rows are numbered in ascending order from 1 to 99. It is possible to skip or delete row numbers. Row number 0 is not allowed.

- Each input signal IN1 to IN10 can only be used once per channel in a control program, otherwise an error message will be displayed. A control program can include up to 99 (linked or unlinked) rows per channel.

- The mimimum number of pulses per row is 1; the maximum is 999.

- The parameter "number of blocks" defines how often a block will be repeated. (One block can consist of one row or several linked rows). For rows or blocks that are triggered via input IN1 to IN10, the number of blocks can be between 1 and 999 (at least 1). For rows or blocks that are not triggered directly, the parameter "number of blocks" = 0. The number of repeats of a block must be defined in the start row of the block under "number of blocks".

- The control program created with the text editor on the PC is saved on an SD card using the USB card reader, and uploaded from the SD card into the memory of the PicoDot valve controller by inserting the card into the slot on the front panel of the valve controller and selecting the Upload function from the operating menu.

3.5 Using the USB SD Card Reader

- If your PC is not equipped with an SD card reader, plug the USB SD card reader supplied with the valve controller into an open USB port on your PC and install the driver software.
- Before using the SD card for the first time, we recommend formatting it in the FAT 16 format (sometimes shown as FAT), using the formatting function of your PC.
- Save the control program.TXT on the SD card.
- Note: Only one control program should be stored on the SD card.
- To upload the control program.TXT from the SD card into the memory of the PicoDot valve controller insert the SD card into the slot on the front of the controller and execute the download under menu item 8/9.
- If the message “Download Successful” is displayed after this program step, all parts of the control program.TXT were successfully uploaded into the memory of the controller.
- If any errors were detected during the download, they will be shown in the display on the front of the controller. (Refer to Appendix A-2).

3.6 Program Examples

3.6.1 Program Example 1

Channel 1 and Channel 2

- Identical control programs for both channels
- Rows are unlinked single rows with 5 pulses each
- No external permanent signal (ext. permanent signal = 0)
- Single start of each row (with input IN1 to IN9)
- Every dispensing cycle is finished automatically after completion of 5 pulses (V-row = 0)
- Different container sizes (channel 1: 1000 g; channel 2: 250 g) are used and thus different maximum remaining quantities (channel 1: 100 g; channel 2: 50 g) are defined as well.

```
[Device]        PDA2+2
[HW Revision]   1.1
[SW Revision]   0.92
[Filename]      PDA_Beispiel_01.txt

[Description]
This file is an example configuration file for the device PDA2+2
[Data]
Code            000000
Valve No.       1
container, full  max. remaining value  adjustment range  temperature    stop  delay time
Gebinde,voll     Grenzrestmenge        Einstellbereich   Temperatur     Stop  Delay-Time
1000             100                   10                35             1     0

row   dosing time  pause time  number of     IN   V-row    delay time   number of    quantity  ext. permanent
                               pulses                                  blocks                 signal.
Zeile Dosierzeit   Pausenzeit  Pulsanzahl   IN   V-Zeile  Verz.-Zeit   Blockanzahl  Menge     ext.Dauers.
1     0.05         0.12        5            1    0        0            1            0.05      0
2     0.5          0.5         5            2    0        0            1            0.25      0
3     5            5           5            3    0        0            1            0.25      0
4     50           50          5            4    0        0            1            0.25      0
5     100          100         5            5    0        0            1            0.25      0
6     500          500         5            6    0        0            1            1         0
7     1000         1000        5            7    0        0            1            2         0
8     5000         5000        5            8    0        0            1            10        0
9     9999.99      9999.99     5            9    0        0            1            100       0

Valve No.       2
container, full  max. remaining value  adjustment range  temperature    stop  delay time
Gebinde,voll     Grenzrestmenge        Einstellbereich   Temperatur     Stop  Delay-Time
250              50                    10                35             1     0

row   dosing time  pause time  number of     IN   V-row    delay time   number of    quantity  ext. permanent
                               pulses                                  blocks                 signal
Zeile Dosierzeit   Pausenzeit  Pulsanzahl   IN   V-Zeile  Verz.-Zeit   Blockanzahl  Menge     ext.Dauers.
1     0.05         0.12        5            1    0        0            1            0.05      0
2     0.5          0.5         5            2    0        0            1            0.25      0
3     5            5           5            3    0        0            1            0.25      0
4     50           50          5            4    0        0            1            0.25      0
5     100          100         5            5    0        0            1            0.25      0
6     500          500         5            6    0        0            1            1         0
7     1000         1000        5            7    0        0            1            2         0
8     5000         5000        5            8    0        0            1            10        0
9     9999.99      9999.99     5            9    0        0            1            100       0
[Data End]
```

3.6.2 Program Example 2

Channel 1

- Rows are linked to blocks (row 1 and 2, row 3 and 4, row 5 and 6, row 7 and 6, row 8 and 7), 1 pulse per row.
- No delay time between the linked rows (delay time = 0) and without external permanent signal (ext. permanent signal = 0).
- Every block and every linked (joined) row can be started individually (via IN1 to IN9).
- The pause time v = variable in row 9, i.e. its duration is varied via the analog input signal between 0 and delay time.
- The dispensing processes are stopped when V-row = 0 is reached (always after completion of row 2, 4, 6 and 9).

Channel 2

- Parameters mainly like the ones of channel 1 but unlinked single rows with 5 pulses each.
- No external permanent signal (ext. permanent signal = 0).
- Single start of each row (via IN1 to IN9) and finished automatically after completion of 5 pulses (V-row = 0).

```
[Device]            PicoDot Valve Controller
[HW Revision]       1.1
[SW Revision]       0.92
[Filename]          PDVC_EXAMPLE_01.TXT

[Description]
This file is a simple configuration file for the PicoDot valve controller.  You may
enter comments of unlimited length.  Square brackets are not allowed.
[Data]
Code                000000
Valve No.           1
Ventil-Nr.          1
```

```
[Device]        PDA2+2
[HW Revision]   1.1
[SW Revision]   0.92
[Filename]      PDA_Beispiel_02.txt

[Description]
This file is an example configuration file for the device PDA2+2

[Data]
Code          000000
Valve No.     1
container, full  max. remaining value  adjustment range  temperature  stop  delay time
Gebinde,voll     Grenzrestmenge        Einstellbereich   Temperatur   Stop  Delay-Time
250              25                    10                35           1     500

row    dosing       pause time  number of      IN  V-row    delay time  number of     quantity  ext. permanent
       time                     pulses                                  blocks                 signal
Zeile  Dosierzeit   Pausenzeit  Pulsanzahl     IN  V-Zeile  Verz.-Zeit  Blockanzahl  Menge     ext.Dauers.
1      0.05         0.12        1              1   2        0           1            0.05      0.
2      0.5          0.5         1              2   0        0           1            0.25      0
3      5            5           1              3   4        0           1            0.25      0
4      60           50          1              4   0        0           1            0.25      0
5      10           5           1              5   6        0           1            0.25      0
6      40           70          1              6   0        0           1            1         0
7      5            10          1              7   6        0           1            2         0
8      80           30          1              8   7        0           1            10        0
9      100          v           1              9   0        0           1            100       0

Valve No.     2
container, full  max. remaining value  adjustment range  temperature  stop  delay time
Gebinde,voll     Grenzrestmenge        Einstellbereich   Temperatur   Stop  Delay-Time
1000             100                   10                35           1     5

row    dosing       pause time  pulse time    IN  V-row    delay time  number of    quantity  ext. permanent
       time                                                            blocks                signal.
Zeile  Dosierzeit   Pausenzeit  Pulsanzahl    IN  V-Zeile  Verz.-Zeit  Blockanzahl  Menge     ext.Dauers.
1      0.05         0.12        5             1   0        0           1            0.05      0
2      0.5          0.5         5             2   0        0           1            0.25      0
3      5            5           5             3   0        0           1            0.25      0
4      50           50          5             4   0        0           1            0.25      0
5      100          100         5             5   0        0           1            0.25      0
6      500          500         5             6   0        0           1            1         0
7      1000         1000        5             7   0        0           1            2         0
8      5000         5000        5             8   0        0           1            10        0
9      9999.99      9999.99     5             9   0        0           1            100       0

[Data End]
```

3.6.3 Program Example 3

Example Using only Channel 1

- All rows are linked to a closed loop without delay times (delay time = 0)
- No external permanent signal (ext. permanent signal = 0)
- The closed loop can be started from any row (via IN1 to IN9) and run infinitely
- The dispensing process is stopped via IN_STOP
- All parameters can be adjusted over the entire dispensing range = v via the PicoDot valve controller.

[Device] PDA2+2
[HW Revision] 1.1
[SW Revision] 0.92
[Filename] PDA_Beispiel_03.txt

[Description]
This file is an example configuration file for the device PDA2+2

[Data]
Code 000000
Valve No. 1

container, full Gebinde,voll	max. remaining value Grenzrestmenge	adjustment range Einstellbereich	temperature Temperatur	stop Stop	delay time Delay-Time
500	25	v	35	1	5

row Zeile	dosing time Dosierzeit	pause time Pausenzeit	number of pulses Pulsanzahl	IN IN	V-row V-Zeile	delay time Verz.-Zeit	number of blocks Blockanzahl	quantity Menge	ext. permanent signal ext.Dauers.
1	100	900	1	1	2	0	1	0.05	0
2	200	800	1	2	3	0	1	0.25	0
3	300	700	1	3	4	0	1	0.25	0
4	400	600	1	4	5	0	1	0.25	0
5	500	500	1	5	6	0	1	0.25	0
6	600	400	1	6	7	0	1	1	0
7	700	300	1	7	8	0	1	2	0
8	800	200	1	8	9	0	1	10	0
9	900	100	1	9	1	0	1	100	0

[Data End]

3.7 Data Communication via CAN Bus

As an alternative to triggering manually or via binary input signals IN1 … IN10, the dispensing process can be triggered via the integrated CAN bus interface. The corresponding settings can be made in the main menu item “Automatic.”

Data transmission in the CAN bus between the parent control and a connected PicoDot valve controller operates in master-slave mode. The parent control is the master. The connected PicoDot valve controllers are the slaves.

Every slave (PicoDot valve controller) connected to the bus has its own address by which it can be addressed. Via this address same can be addressed by the master (parent control). The transfer rate used for communication can be selected. The address and the transfer rate have to be set in the program of each PicoDot valve controller involved under the main menu item “System Data.”

For additional information on how to use the CAN bus interface, please contact EFD.

3.8 Value Ranges for Addresses and Transfer Rates

(parameter selection, factory settings, values after factory reset).

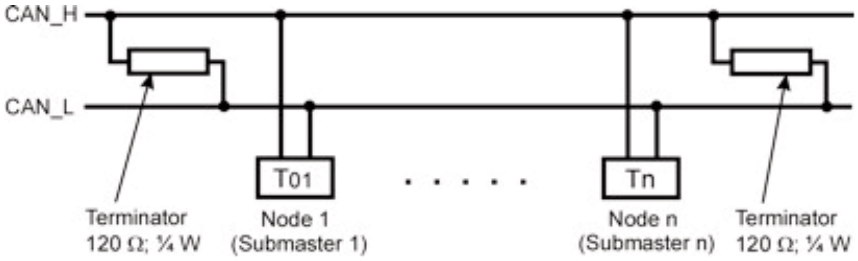
Parameter	Value Range	Factory Setting (default value) and setting after Factory Reset
CAN address range	0 to 63	address 63
Possible transfer rates	125 kBit/s	125 kBit/s
	250 kBit/s	
	500 kBit/s	

3.9 Communication

The PicoDot valve controller uses the standard CAN protocol format (11-bit-identifier) according to the CAN specification 2. With this protocol a request (Request) is answered (Response) as quickly as possible. The duration of the response time de-pends on the transfer rate and the current status of the PicoDot valve controller. A typical response time is less than 2 ms.

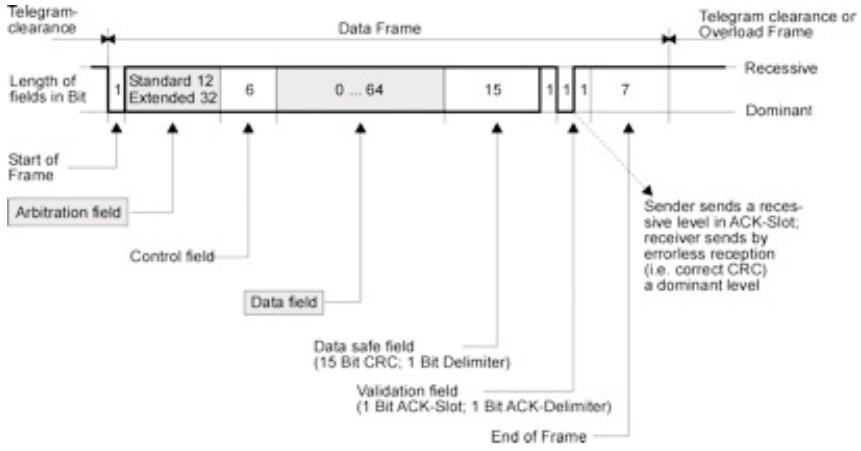
3.10 Network Installation

During the network installation you have to pay special attention to the termination of the bus. Connect a terminator of 120 Ω with ¼ W loss (see drawing) at both ends of the bus between CAN_H and CAN_L (Pin 2 and Pin 7 of the CAN bus interface at the PicoDot valve controller).



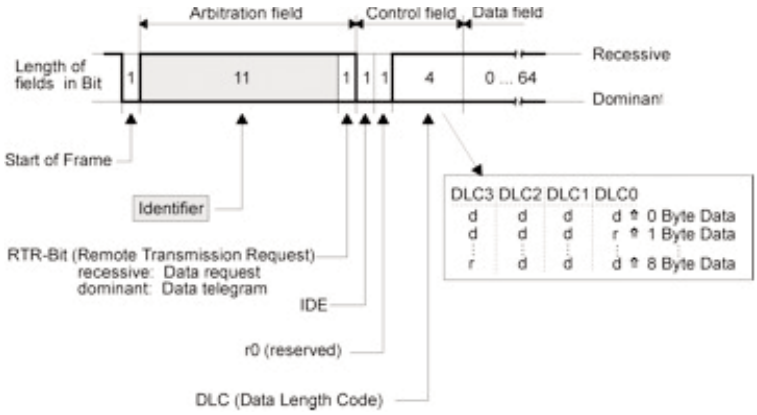
3.11 Structure of a CAN Data Telegram

Communication in a CAN bus is achieved by sending data telegrams. These data telegrams contain process data for the network management and backup data. At least 3 recessive bits have to be between 2 telegrams (data frame or remote frame).



3.12 Structure of the Arbitration Field and the Control Field

The standard format of the arbitration field is used for the PicoDot valve controller. In the standard format the arbitration field and the control field are designed according the following drawing.



3.13 Identifier, Data Field and Data Transmission to CAN Master

3.13.1 Identifier

The identifier is part of the CAN data telegram. It is designed by the programmer according to the device specifications, comprises 11 bits and is designed as shown below. The bits are sent from the left to the right, i.e., bit 10 is the one the identifier transmits first.

Bit 10	Bit 9 Bit 8 Bit 7 Bit 6	Bit 5 Bit 4 Bit 3 Bit 2 Bit 1 Bit 0
Sender	command code, 4-digit	slave address, 6-digit

Bit 10 informs about the sender of the data telegram (master request: bit 10 = 0; slave response: bit 10 = 1).

Bit 9 to 6 includes the command code in the form of a 4-digit binary number.
Example: command “start row” = 5 decimal = 5 hexadecimal = 0101 binary.

In Bit 5 to 0 the slave address to be triggered (the PicoDot valve controller to be triggered) is saved as a 6-digit binary number (maximum 64 addresses).
Example: address = 10 decimal = 0A hexadecimal = 001010 binary.

3.13.2 Data Field

The data field is also part of the CAN data telegram. It can be 0 to 64 bits long, includes useful data and is transmitted subsequent to the control field. The useful data include further information regarding the command execution, e.g., the number of the valve, start row to be called, error in the PicoDot valve controller and others.

The data field can contain 8 bytes of data. The user data will be sent to the CAN master in a device-specific form and stored as a databyte (8- digit binary number) in the data field of the CAN data telegram. The user data are transmitted to a CAN master according to the device specifications.

3.13.3 Commands for CAN Communication

When the master sends a command (request) to the slave, the slave will check its own status and react as follows:

- If there are no errors, error the slave (PicoDot valve controller) will begin executing the command and send a response to the master.
- If there is an error, the command will not be executed and the slave will send a response to the master with the problem report. After solving the error and sending the command to the slave, the command will be executed.

Command List for Communication with the PicoDot valve Controller

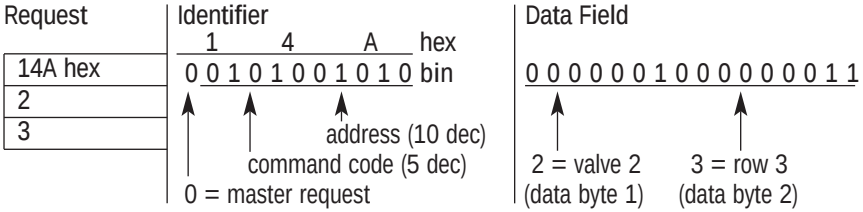
Command and Command Code	Type of CAN Data Telegram	Part of CAN Data Telegram	Structure of Telegram Part	Encoded Information
Start valve command code 5 decimal 0101 binary	Request (from Master to Slave)	identifier	11 bit binary	sender: 0 command code: 5 slave address:
		data field	data byte 1 and 2 (2 x 8 bit)	valve no. row no.
	Response (from slave to master)	identifier	11 bit binary	sender: 1 command code: 5 slave address:
		data field	error byte 0, 1, 2 or 3 (1 x 8 bit)	0 = no error 1 = valve not in CAN-mode 2 = dispensing still active 3 = stop activated
Stop valve command code 6 decimal 0110 binary	Request (from master to slave)	identifier	11 bit binary	sender: 0 command code: 6 slave address:
		data field	data byte1 (1 x 8 Bit)	valve no.
	Response (from slave to master)	identifier	11 bit binary	sender: 1 command code: 6 slave-address:
		data field	error byte 0, 1, 2 or 3 (1 x 8 bit)	0 = no error 1 = valve not in CAN-mode 2 = dispensing not active 3 = internal communication error

3.13.4 Example of a CAN Data Telegram

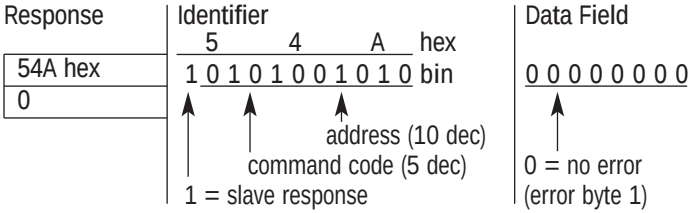
The identifier is part of the CAN data telegram. It is designed by the programmer according to the device specifications, comprises 11 bits and is designed as shown below. The bits are sent from the left to the right, i.e., bit 10 is the one the identifier transmits first.

Parameter	Value		
	Decimal	Hexadecimal	Binary
Start row	5	5	0101
Address of the PicoDot Valve Controller	10	0A	001010
Valve no.	2	2	00000010
Row no.	3	2	00000011

The programmer transmits these data to the master in the requested number format. These data are the basis for the creation of the identifier and for the data field for a master request (telegram of the master to the slave) in cooperation with the software of the master. For this example the identifier and the data field of the master request have the following structure:



Having received the data telegram, the slave answers by sending a response. The response includes the identifier with “1” assigned to bit 10. The status of the slave is indicated in the data field by an error byte. If the triggered address can execute the transmitted command, the identifier and the data field of the slave response have the following structure.



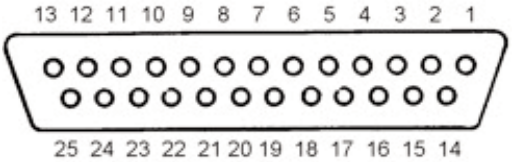
Remarks

- When the CAN bus communication is activated, the operating alternatives “manual operation” and “automatic” are deactivated.

- To activate the emergency stop function of the PicoDot valve controller, set parameter “stop = 1” in the valve program. With “stop = 0” in the valve program the emergency stop function is deactivated (e.g. for test purposes).

4 Configuration of the Connection Sockets and Signal Levels

4.1 Pin Configuration of the 25-pin Sub-D-Sockets



Every channel of the PicoDot valve controller is equipped with a 25-pin sub-d-socket. All channel-specific in-put and output signals are connected via this interface.

The input signals IN1 to IN10 as well as IN_STOP serve as controls of the channel output signals (pulse-pause blocks). These input signals can be created by means of switches (manual or foot switch, limit switch, relay, light barriers, etc.) or electronic control units (PLC, industrial PC, etc.).

Pin	Signal	Remark
1	DGND	Internal 0 V reference potential 0 V
2	GND_IO	0 V reference potential for inputs and outputs
3	24 V	Internal 24 V voltage used as control voltage for the binary inputs/outputs with external semiconductor relay
4	24 V_IO	external 24 V voltage for the outputs
5	IN1	binary input 1 to activate a block (reference GND_IO)
6	IN2	binary input 2 to activate a block (reference GND_IO)
7	IN3	binary input 3 to activate a block (reference GND_IO)
8	IN4	binary input 4 to activate a block (reference GND_IO)
9	IN5	binary input 5 to activate a block (reference GND_IO)
10	IN6	binary input 6 to activate a block (reference GND_IO)
11	IN7	binary input 7 to activate a block (reference GND_IO)
12	IN8	binary input 8 to activate a block (reference GND_IO)
13	IN9	binary input 9 to activate a block (reference GND_IO)
14	IN10	binary input 10 to activate a block (reference GND_IO)
15	IN_STOP	binary input emergency stop (High – Low; reference GND_IO)
16	IN_TEMP_PLC	binary input “maximum fluid temperature reached” from valve driver (reference DGND)
17	IN_FAULT_PLC	binary input “fault dispensing process” from valve driver (reference DGND)
18	IN_ANALOG	analog input 0…10 V (reference DGND); controls pause-times configured with V between 0 and delay time
19	OUT_READY	binary output to display that the channel is ready to operate (reference GND_IO)
20	OUT_END_OF_ROW	binary output to display that the pulse output in the channel has been completed (reference GND_IO); 24 V, 100 ms
21	OUT_TEMP_PLC	binary output alarm “maximum fluid temperature” as input IN_TEMP_PLC (reference GND_IO) being looped in
22	OUT_FAULT_PLC	binary output fault dispensing process (maximum value reached upon level control or no valve driver detected) IN_FAULT_PLC (reference GND_IO)
23	OUT_ANALOG	analog output 0…5 V, temperature setpoint at valve driver (reference DGND)
24	PULSE_OUT	output signal pulse-pause-block (reference DGND)
25	DGND	Internal 0 V reference potential

Attention

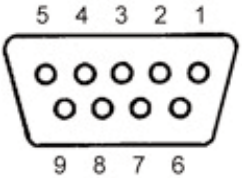
- *Pin 17 in the 25-pin Sub-D-Socket of the connection cable is an output from valve driver. It can be checked by the PLC.

- To start the dispensing process, it is necessary to apply a 12 to 30 V signal to Pin 17. If the emergency stop input is activated, a 12 to 30 V signal to Pin 15 is required as well.

- For testing the valve driver the following pins can be connected:
  Pins 1 and 2 eliminates the electric separation
  Pins 3 on 4, 15 and 17 uses the internal 24 V signal for testing

4.2 Pin Configuration of the 9-pin Sub-D-Socket

CAN bus interface



Via the CAN bus interface, the PicoDot valve controller can optionally communicate with a higher level controller, e.g., the production machine.
Without communication the device operates in stand-alone operating mode.

Pin	Signal	Remark
1	–	not used
2	CAN_LOW	data line
3	GND	reference potential CAN
4	–	not used
5	–	not used
6	–	not used
7	CAN_HIGH	data line
8	–	not used
9	–	not used

4.3 Sources for the Signal Levels

The following signal levels are valid for the input and output signals.

Input Level	Low (0 to + 5 V)	High (+12 to +30 V)
Effect on IN1 to IN10	IN1 to IN10 not active	IN1 to IN10 is activated
Effect on IN_STOP	IN_STOP active = emergency stop	IN_STOP not active = no emergency stop
Output Level	0 V	24 V
Meaning OUT_READY	0 V = not ready to operate	24 V = ready to operate
Meaning OUT_END_OF_ROW	0 V = no information possible	24 V-pulse having a duration of 100 ms = end of pulse output
OUT_TEMP_PLC	0 V = fluid temperature disturbed	24 V = fluid temperature normal
OUT_FAULT_PLC	0 V = process disturbed	24 V = process normal
Output signal channel 1-4	0 V = no dispensing process	24 V = dispensing process active

The signal levels/potentials of the binary input and output signals can be provided by the internal power supply of the PicoDot valve controller or by an external supply (PLC, power supply, etc.).

As a factory setting, the binary input and output signals of the PicoDot valve controller are electrically separated from the power supply. Depending on the selected voltage signal, please note the following requirements when wiring the 25-pin sub-d-plug (channel 1 to 4).

4.3.1 Using the Internal 24 V Signal

The internal 24 V signal is provided by the power supply of the PicoDot valve controller. This version is typically used with potential-free switches and push-buttons to activate the pulse sequences.

4.3.2 Setup for Using the Internal 24 V Signal

To use the internal 24 V signal it is necessary to connect the following pins in the 25-pin connector for the corresponding channels:

DGND and GND_IO-points (i.e. bridge between PIN 1 and 2) as well as
24 V and 24 V_IO-points (i.e. bridge between PIN 3 and 4).

By connecting these pins, the electric separation is eliminated.

The potential of 24 V is applied to the normally open contact (IN1 to IN10) or the normally closed contact (IN_STOP) and triggers the corresponding action (start of a pulse sequence or emergency stop). The output signals can be used as optical or acoustic signals. Total power must not exceed 10 W.

4.3.3 Using an External 24 V Signal

The external 24 V signal is typically used if the parent control signal has its own power supply (PLC, control electronics, etc.) and if the inputs IN1 to IN10 as well as IN_STOP are triggered directly via binary signals. In this case the external voltage supply is connected to the inputs and outputs of the PicoDot valve controller.

4.3.4 Setup for Using an External 24 V Signal

The 24 V_IO and GND_IO pins must be connected to the corresponding binding posts of the external voltage supply. It is also necessary to wire the input signals IN1 to IN10 directly. The output signals OUT_READY and OUT_END_OF_RUN are mainly used as response functions for the control program.

5 Maintenance and Cleaning of the PicoDot Valve Controller

5.1 Maintenance

All parts of the PicoDot valve controller are maintenance-free; scheduled maintenance is not necessary. Entered data and parameters are saved in a non-volatile memory EEPROM/Flash that will retain data for approximately 20 years. This environmentally friendly memory does not require a battery backup.

5.2 Cleaning

Clean the outer components with a soft cloth and a mild cleaning agent if required.

⚠ CAUTION

Do not use any solvents or abrasives, because they could damage the surface of the valve controller. Ensure that no cleaning agents get into the valve controller.

⚠ ATTENTION

Do not open the valve controller. Doing so will void the warranty.

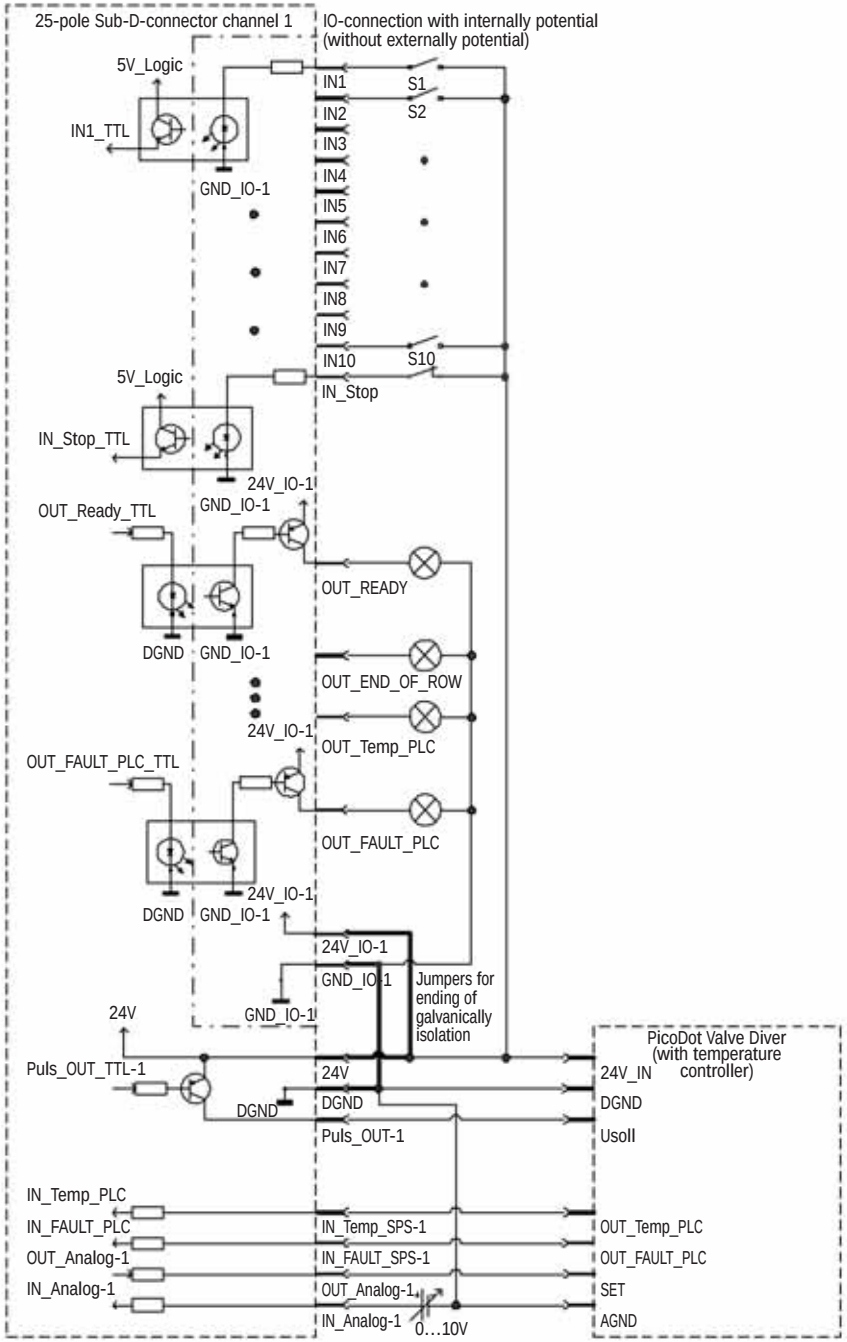
A-1 Technical Specifications

Enclosure	Plug-in cassette for 19"; aluminium, black anodized
Dimensions W x H x D	142 x 129 x 171 mm (3HE, 28 TE) (6.60 x 5.08 x 6.73")
Ambient operating temperature	+5 to +50°C (41°F to 122°F)
Relative operating humidity	Max. 80%
Storage temperature	-20 to +70°C (-4°F to 158V°F)
Relative storage humidity	Max. 90%
Supply voltage	90 to 264 V / 47 to 63 Hz
Switching power supply	For internal supply with low voltage, double insulated
Power consumption	Max. 30 W (50 ms after switching on) max. 0.3 A (max. 50 ms)
Nominal working method	Continuous operation
Electric supply	Two-pin with flexible lead, non-polarity xxxxxx??
Protection class	IP20 with protective insulation
Memory	Non-volatile storage (EEPROM and Flash-Memory)
Menu languages	Operating menu in three languages (German, English, French)
Output signal	24 V DC
Time ranges	Separate allocation for each row and channel
Pulse time (dosage time)	0.050 ms to 9999.99 ms ±0.0005 ms each pulse (0.010 ms increments)
Pause time	0.120 ms to 9999.99 ms ±0.0005 ms each pause (0.010 ms increments)
Delay time	0 to 10 s between 2 linked rows; 1 ms increments
Manual input devices	1 incremental encoder and 2 operating keys
Display	Graphic display blue/white, 128 x 64 Pixel
CAN interface	Option to communicate with higher-level control unit
Number of channels Input signals/channel	2 or 4 independent output channels
1 analog input	0 … 10 V; for variable pause-times (times between 0 and delay time; delay time = 0 to 10000 ms)
10 binary input signals	to activate one pulse-pause-row (resp. block) each
Stop/emergency stop	Immediate stop of a current dispensing process
Temperature dispensing fluid	Alarm upon exceeding the maximum temperature for the dispensing fluid (valve driver signal to the higher level control)
Dispensing process fault	Alarm in case of dispensing process error (valve driver signal to the higher level control)
Output signals/channel	
Pulse-pause-outputs	Electric 24 V pulses to control dispensing processes
Ready	0 V = not ready for work, 24 V ±20% = ready for work
End of pulse sequence	24 V-pulse having a duration of 100 ms
Fluid temperature	24 V = normal; 0 V = exceeds maximum temperature
Dispensing process fault	24 V = normal; 0 V = dispensing process disturbed (maximum value reached upon level control or no CON)
Analog output	(0 to 5 V) Set value for the fluid temperature
Electric supplies	
CAN-interface	9-pin sub-d-socket
In-/outputs for each channel	25-pin sub-d-socket for each channel
Load outputs	Pulse output approx. 2 W (80 mA) other outputs approx. 0.5 W (20 mA)
Status display channel	Per channel 1 green LED for status display
Utility position	Display in front, connecting sockets easily accessible
Weight	Approx. 1.5 kg (3 lb, 5 oz)

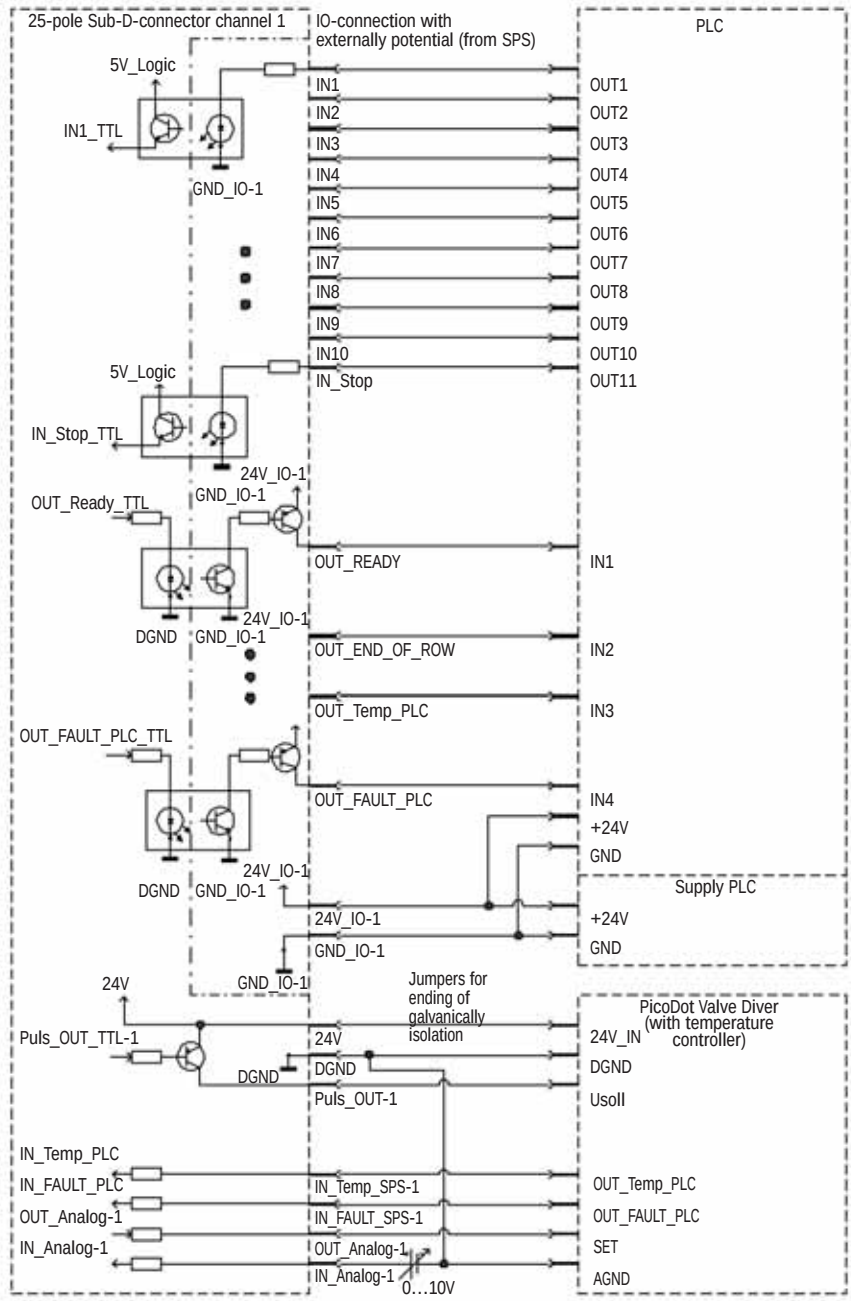
A-2 Troubleshooting

Error	Possible Cause	Solution
Despite start signal, the dispensing cycle does not start (green channel LED does not flash)	No IN_STOP-signal (24 V DC) at Pin 15	Apply 24 V DC to Pin 15 or download program with parameter "Stop" = 0
	No IN_FAULT_PLC signal (24 V DC with DGND)	Connect PicoDot valve driver and remove error from the valve driver, or apply 24 VDC to Pin 17
Display after download Init. Error	Contacts of the SD card to the control valve might not be correct	Adjust position of the SD card in the valve controller and repeat download
Display after download read-/ data error	SD card has been removed during the download, electrical contacts have to be improved	Clean the contacts and repeat download
Display after download No file found	SD card not formatted or no file on the card	Format SD card in FAT16 format (also known as FAT in Windows). Save program on SD card and download again.
Display after download No PDA file	Control file on the SD-Card is not a valid program file for the PDA	Check file and repeat download
Display after download Valve x: Error row y	Parameters or structure of the control program wrong x valve number y parameter row is shown row 0 is for general data	Check row, correct error and repeat download
Various clear text error displays after download	Value range or data structure in the control program on the SD card wrong	Adjust control program via PC and download again from SD card
Display max. value reached execute replace container?	Calculated remaining quantity of the dispensing fluid in the container has reached defined maximum value; status signal IN_FAULT_PLC informs PLC; dispensing process is not interrupted automatically	Check actual fluid quantity remaining in the container and decide whether to replace the container (ENTER) or continue dispensing (ESCAPE)
Display container empty execute replace container?	Container is empty according to calculation; no signal to PLC; dispensing process is not interrupted automatically; until container replacement information is displayed every 5 minutes	Check fluid quantity in the container and decide whether to replace the container (ENTER) or continue dispensing (ESCAPE)
Display error memory	Faulty internal communication to the EEPROM (e.g. due to extreme electromagnetic disturbances)	Repeat operating step; if retry is unsuccessful, return controller to EFD for service

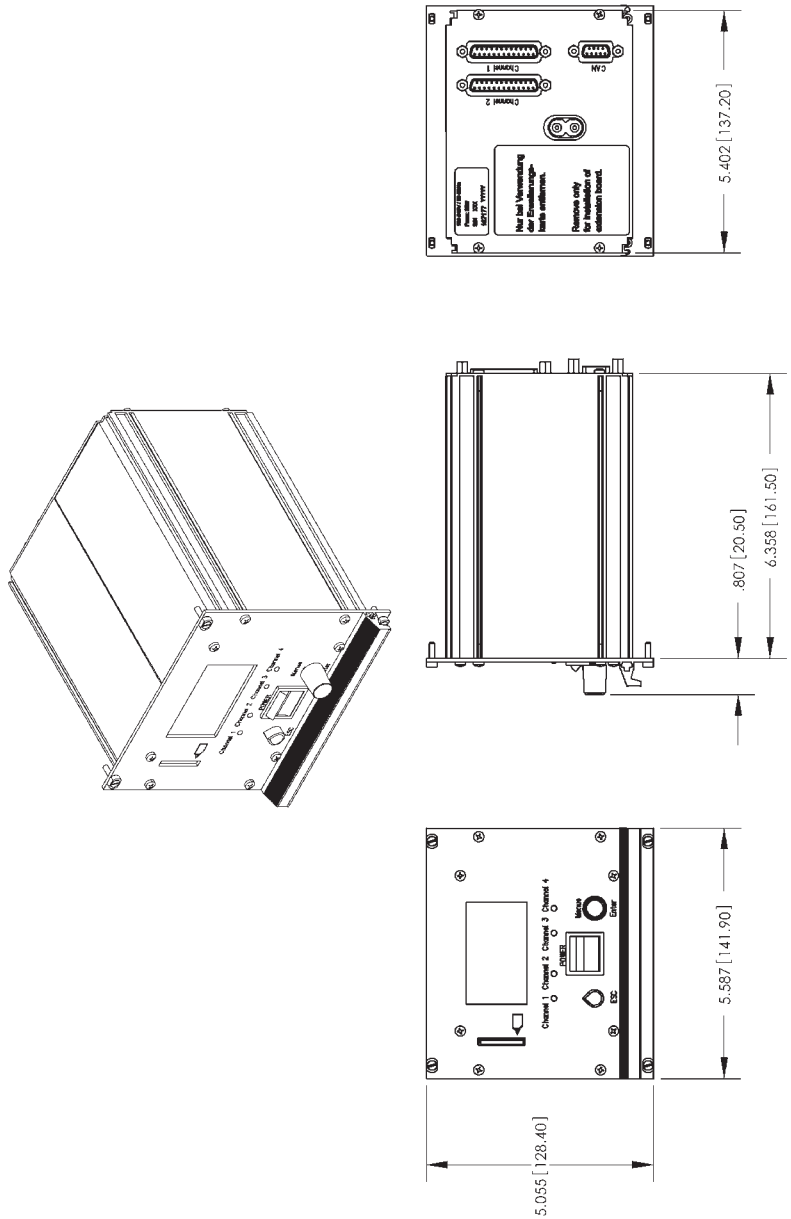
A-3 I/O Connection with Internal Potential



A-4 I/O Connection with External Potential (from PLC)



A-5 PicoDot Valve Controller



A-5 PicoDot Valve Controller