HYDROTECHNIK

ENG

HySense® QL 326
Load valve

Manual

Version 1.1 ENG

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1 SAFETY

	Warning
	Danger of bursting due to contaminated nozzles! *The pressure on the load valve is relieved via pilot control and nozzles, which can be clogged by impurities in the fluid. This can lead to overload, which can cause components to blow off or fluid to leak. Install an effective pressure relief valve upstream of the load valve!*

General safety instructions and warnings

- Do not cut, damage or modify the connection cables or place any objects on them.
- Never touch the control box with wet or clammy hands.
- Connect the device only to power supplies for which it is suitable (see technical data).
- Disconnect the power cord from the load outlet during a thunderstorm.
- Unplug the power cord from the outlet if you notice an odor or smoke, or if the cord is damaged.
- Make sure your system is properly grounded. Incorrect grounding may result in incorrect measurements.

Notes on handling the load valve

- Do not expose the control box to excessive heat or moisture, respect the technical data.
- Do not store the unit in damp and dusty places or in temperatures below freezing.
- Do not immerse the unit in water or other liquids. Never allow liquids to get inside the unit.
- Never open the device
- Do not use the unit after it has been dropped or the housing is damaged.
- Avoid strong magnetic fields. Keep the device away from electric motors or other devices that generate electromagnetic fields. Strong magnetic fields can cause malfunction and affect readings.

2 INTRODUCTION

	Note
	The information and notes in this section are important. Failure to do so may invalidate any claims under warranty and guarantee.

Scope

These operating instructions apply to load sections designated "QL 326". It is intended for operator who are working with the unit. This is not a technical manual. For questions that go beyond the contents of this manual, please contact our customer service.

Copyright

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The technical status at the time of delivery of the device and instructions is decisive, unless other information is provided. We reserve the right to make technical changes without special notice. Earlier instructions lose their validity. The General Conditions of Sale and Delivery of Hydrotechnik GmbH apply.

Disclaimer

We guarantee the fault-free functioning of our product in accordance with our advertising, the product information published by us and this manual. Further product characteristics are not promised. We accept no liability for economic efficiency and faultless function, if the product is used for a purpose other than that described in the section "Intended use".

Compensation for damages is generally excluded, except in cases of intent or gross negligence on the part of Hydrotechnik GmbH or if promised product properties are not available. If this product is used in environments for which it is not suitable or which do not meet the technical standard, we are not responsible for the consequences.

We accept no liability for damage to equipment and systems in the vicinity of the product caused by a fault in the product or in this manual.

We are not responsible for the infringement of patents and/or other rights of third parties outside the Federal Republic of Germany.

We are not liable for damage caused by improper operation and not following the instructions in this manual. We are not liable for loss of profit and consequential damage due to non-observance of safety and warning instructions. We accept no liability for damage caused by the use of accessories and/or wearing parts that were not supplied or certified by Hydrotechnik GmbH.

The products of Hydrotechnik GmbH are designed for a long service life. They correspond to the state of science and technology and were individually tested in all functions before delivery. The electrical and mechanical construction complies with the applicable standards and guidelines. Hydrotechnik GmbH conducts ongoing product and market research in order to promote the continuous development and improvement of its products.

In case of malfunctions and/or technical problems, please contact the Hydrotechnik GmbH customer service. We assure you, that suitable measures will be taken immediately. The warranty conditions of Hydrotechnik GmbH apply, which we will be pleased to send you on request.

Intended use

The device "QL 326" is a load line controlled via a bus system, which is equipped with a proportional pressure relief valve with preamplifier. It is used to measure pressure, volume flow and temperature. The integrated proportional valve can be used to simulate a load in order to measure the behaviour of, for example, a hydraulic pump under load. A pre-programmed pressure curve (setpoint 0...100% corresponding to 0...10V) of the load curve is run to obtain reliably reproducible test sequences. No setpoint/process value comparison is carried out and no control is performed.

Any other use of this device is considered improper. If you have any questions or wish to use the unit for any other purpose, please contact our customer service. We will be happy to help you with any necessary configurations.

Guarantee

For this device, we guarantee perfect condition for a period of six months within the scope of our warranty conditions. Wearing parts are excluded from this guarantee. The warranty claim expires if repairs or interventions are carried out by persons who are not authorized by us.

Within the warranty period, we will remedy free of charge any damage or defects that are demonstrably based on a factory defect, provided that we are notified of such defects immediately upon their discovery, but no later than within six months of delivery. The guarantee is provided at our discretion by repairing defective parts free of charge or replacing them with faultless parts.

Send devices for which a warranty claim is made to the Hydrotechnik GmbH customer service centre carriage paid and with a copy of the invoice or delivery note. You will find the address at the end of this manual.

Obligations of the customer

The operator of this device must ensure that only persons who

- know the rules of work safety and accident prevention
- were instructed in the operation of this measuring instrument
- have read and understood this manual completely

be able to use and operate this device.

Persons who operate this measuring instrument are obliged

- to observe all rules of work safety and accident prevention
- to read this manual completely, especially the safety instructions in the first chapter.

Authorized personnel

Persons are regarded as authorized who have completed professional training, have technical experience and knowledge of the relevant standards and guidelines and who are able to assess the tasks assigned to them and recognize possible dangers at an early stage.

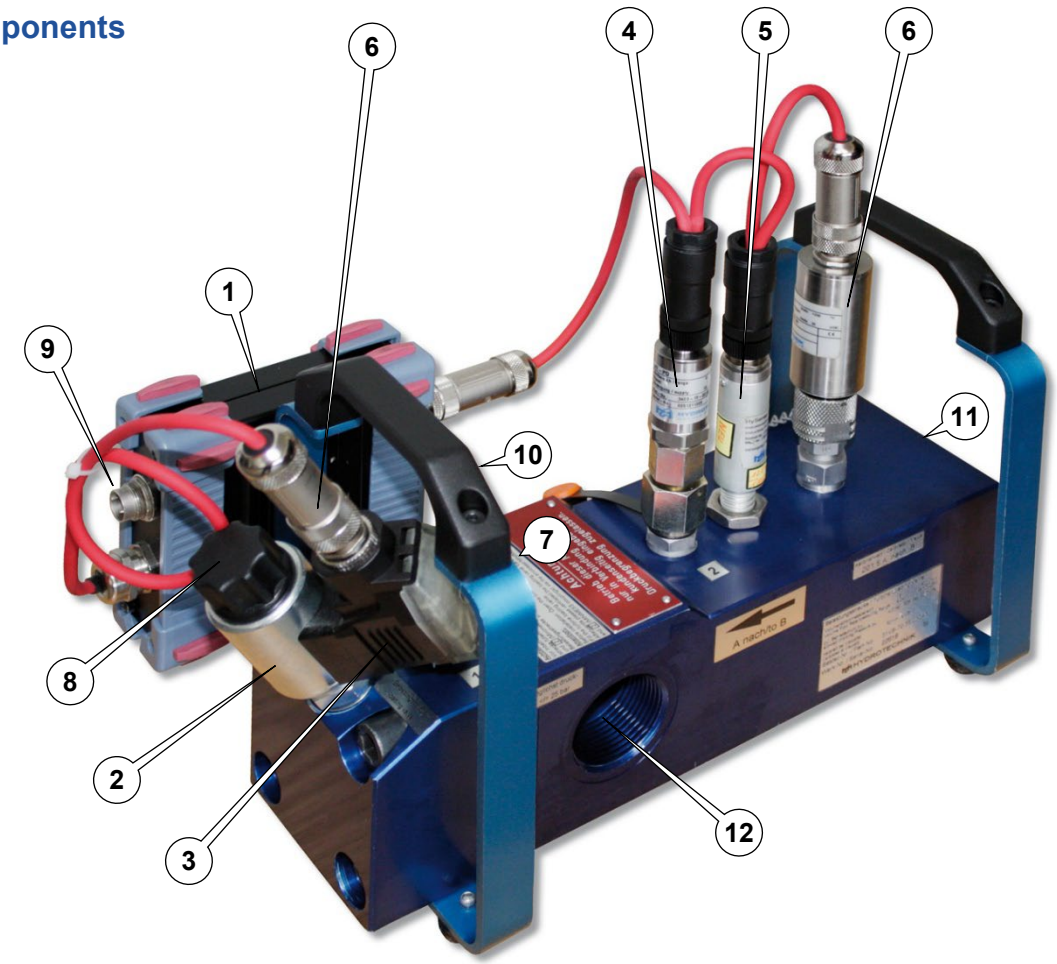
Operator of the device

Persons are considered authorized who have been instructed in the operation of the device and have read and understood this manual completely.

Personnel for installation and maintenance

Persons are considered authorized who have been instructed in all aspects of the device and have read and understood this manual completely.

Components



1	Control box	receives the device settings from the measuring device and controls the proportional valve (pilot circuit)
2	Proportional valve with amplifier	Controls the flow rate according to the programmed characteristic curve (set point)
3	Amplifier	Proportional valve amplifier
4	CAN Pressure Sensor	Pressure measurement
5	CAN inductive transducer	Volume flow measurement
6	CAN temperature sensor	Temperature measurement
7	Minimess® test point	Venting and measuring point for pilot pressure
8	Venting screw	Venting screw of the proportional valve under screw cap
9	Power supply	Power supply for control box, CAN sensors and proportional valve amplifier
10	CAN port	Connection for measuring instrument or CAN bus
11	Inlet port	ISO226-G1 1/4
12	Outlet port	ISO226-G1 1/4

Intended use of the QL 326

The QL 326 load valve is a further development of the proven QL 2xx load valve. The manually operated throttle valve was replaced by a proportional pressure relief valve with preamplifier. The excellent technical properties of the previous version (nominal pressure, maximum volume flow, error limits, etc.) were completely retained.

The programming of the load valve is carried out either by the Hydrotechnik measuring device or by means of the available CAN commands when connected to an existing CAN bus.

During operation of the load line, previously defined test parameters are transmitted to the control box via CAN bus. The control box controls the proportional valve. The load valve is capable of processing a defined load profile (ramp or sine) as a single action or in several cycles. Identical loads can be run several times in succession.

The load valve considerably simplifies the adjustment of pressure relief valves and the testing of pumps, e.g. the recording of the characteristic curve as a function of pressure, as a non-existent load can be simulated exactly and reproducibly.

The components volume flow sensor (turbine) and proportional valve as well as measuring points for pressure and temperature are combined in one unit. The mechanical connection (inlet/outlet) is designed as a female thread ISO 150 228-G 1¼".

For safe operation of the load line, we recommend the installation of an external pressure protection. This must be installed by the customer, e.g. by installing a pressure relief valve upstream of the load valve, or via the upstream hydraulic system. The device must not be used for control purposes.

Commissioning

Wear eye protection!

Wear hand protection!

	Attention
	Damage to the turbine wheel possible! *Commissioning and venting may only be carried out at a flow rate of max. 30 l/min and a pressure of 30 bar. Otherwise, the turbine wheel can be damaged by the air contained in the system.*

	Warning
	Hydraulic oil can blind you! *Immediately after connecting the Minimess® measuring hose, the hydraulic oil contained in the system escapes from the hose. Take care not to get the oil in your eyes or on your skin. This can cause serious injuries such as blindness or skin irritation. Wear safety glasses and protective gloves! Have suitable collecting containers for the hydraulic oil ready!*

Technical data

Mechanical data

Material housing	3.4365
... turbine wheel	1.0718
... Seals	FKM
Mechanical connection	ISO 228 - G 1¼"
Mounting position	any
Weight	approx. 6,5 kg
Medium temperature	max. 120 °C
Ambient / storage temperature	-20...+65 °C

Hydraulic data

Permissible operating pressure	420 bar
Measuring range	16...600 l/min
Calibration viscosity	30 mm²/s (cSt)
Viscosity range	1...100 mm²/s (cSt)
Recommended filter	10 µm

Electrical data of the sensors

Output signal	CAN 2.0A
Electrical measuring connection	M12x1 5-pin plug
Protection class	IP 40 (EN 60529 / IEC 529)
Supply voltage Ub	12...24 VDC
Power consumption	max. 1 A
Overvoltage protection	36 VDC
Response time	≤ 50 ms

Electrical data of the control box

Input signal	CAN 2.0A
Control signal to proportional valve	0...10V ([1])
Connection Input/Output	M12x1 5-pin socket and plug
Connection Supply voltage	M16x0,75 3-pin connector
Supply voltage Ub	12...24 VDC
Power consumption	max. 1 A

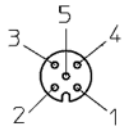
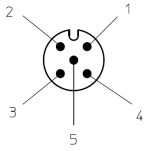
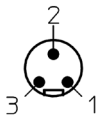
Measurement accuracy

Flow rate	±0.5% of MW @ 30mm²/s (cSt)
Pressure	typ. ±0.5% of MW ([2])
Temperature	typ. ±2°K (2)

([1]) When used in the CAN bus, this range corresponds to the default value 0...100% (0…10V).

([2]) Detailed information on the measuring accuracy of the individual sensors can be found in the corresponding product data sheets.

Connections control box

CAN socket M12 x 1 with screw lock A-coding, 5-pin, socket IEC / DIN EN 61076-2-101			
M12 A 5p f 	1	CAN SHLD	CAN shield
	2	CAN Ub	CAN supply
	3	CAN GND	CAN ground
	4	CAN H	CAN high
	5	CAN L	CAN low
CAN connector M12 x 1 with screw lock A-coding, 5-pin, connector IEC / DIN EN 61076-2-101			
M12 A 5p m 	1	CAN SHLD	CAN shield
	2	CAN Ub	CAN supply
	3	CAN GND	CAN ground
	4	CAN H	CAN high
	5	CAN L	CAN low
Supply connector M16 x 0.75 3-pin, connector			
M16 3p m 	1	PWR+	Power supply control box 24VDC (+)
	2	NC	Un-associated
	3	PWR-	Power supply control box Ground (GND)

Connect

Connecting to a Hydrotechnik measuring instrument with CAN functionality

1. Connect the control box of the QL 326 with the CAN data cable to the measuring instrument.
2. Connect the power supply unit to the supply plug of the control box.
3. Please refer to the operating manual of the measuring instrument for further information.

Connecting to an existing CAN bus

1. Connect the control box of the QL 326 with the CAN data cable to the existing CAN bus.
2. Connect the power supply unit to the supply plug of the control box.

Venting

After the load valve has been installed in a measuring point, it must be vented during the first two minutes of operation.

1. Remove the protective cap (pos.8, page 3) on the proportional valve to gain access to the venting screw underneath.
2. Connect a Minimess® measuring hose to the Minimess® test point (pos.7, page 3).
   Caution: Oil-air mixture of the system immediately escape at the hose end.
3. Let the oil-air mixture contained in the load valve escape and simultaneously open the vent screw in the proportional valve by one to two turns with a Phillips screwdriver.
4. Wait until the oil flows out evenly without interruptions or bubbles.
5. Close the bleed screw in the proportional valve.
6. Remove the Minimess® measuring hose from the test point.
7. Mount the protective cap on the proportional valve

4 OPERATION WITH MS5060 PLUS

With the **MultiSystem 5060** *Plus,* you can program the electronically controlled load valve **HySense QL 326** and operate it in various operating modes.

Activating the CAN-BUS

Start the **MultiSystem 5060** *Plus* and activate the CAN bus in the "DEVICE" menu. Set the baud rate to 125kBit/s. With F5 (OK) you leave the menu.

1 Press MENU to open the menu.

2 Use △▽ to highlight **Device** and press ENT .

3 Use △▽ to highlight **Can** and press ENT .

4 Use △▽ to highlight the **Baud rate** and press ENT .

5 Use △▽ to select select **125kBit/s** and press ENT .

6 Exit the settings with F5 **(OK).**

Starting the application Load valve

Select the "Special Applications" menu and open the menu with ENT. Select the "Load valve" menu.

1 Press to MENU open the menu.

2 Use △▽ to highlight **Special Applications** and press ENT.

3 Use △▽ to highlight **Load valve** and press ENT.

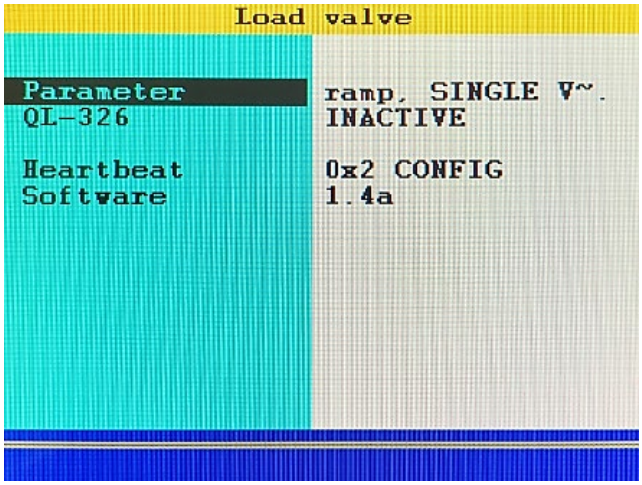
4 Via F3 (CONFIG) the connected sensors are recognized. Select "YES", to add the sensors to the display.

5 Confirm with the ENT menu "Load valve" - CAN-BUS is scanned again and you reach the programming level.

6 Use △▽ to highlight **Parameter** and press ENT.

You are now at the programming level of the load valve.

In the "Parameter" menu you can set the operating mode "MANUAL", "RAMP", "SINUS" or "INACTIVE".



Parameters Shows the current configuration of the load valve

Use △▽ to highlight **Parameter** and press ENT.

Note: You can only program the load valve if it is **INACTIVE**

Device or QL-326 If no load valve is connected to the measuring instrument **device** is displayed. If a load valve is connected to the measuring instrument, the short designation **QL-326** is displayed.

QL326 is **INACTIVE,**
- then you can configure the parameters of the load valve
- the load valve cannot be operated in this state

QL326 is **CONNECTED,**
- the load valve can be operated in this state
- a configuration is not possible

Heartbeat The measuring instrument communicates with the load valve when **ACTIVE** is displayed. The code before **ACTIVE** indicates the state of communication.

Software Shows the software version of the load valve.

Programming the load valve

Note: You can only program the load distance if it is **INACTIVE.**

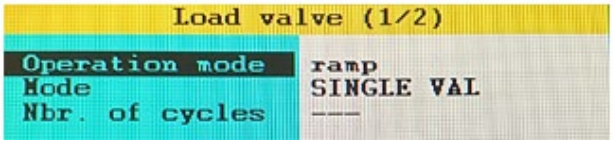
You can define the operating modes in the **Load valve (1/2)** dialog.

1 Press to MENU open the menu.

2 Use △▽ to highlight **Special Applications** and press ENT .

3 Use △▽ to highlight **Load distance** and press ENT .

4 Use △▽ to highlight **Parameter** and press ENT .



You can define the behaviour of the load valve in the dialog:

Operating mode Press to select ENT the desired operating mode:

Ramp	The valve follows the curve of a defined ramp see **programming operating mode ramp**
Sine	The valve follows a sinusoidal curve. see **programming operating mode sine**
Inactive	The load valve is switched off.
Manual	The proportional valve of the load valve is operated manually via the function keys F3 F4

Mode Press ENT and select between the following options.

CYCLICAL	Ramp/sine is repeatedly run down. The number of repetitions is defined as **Nbr. of cycles**.
SINGLE VAL	Ramp/sine is run exactly once.

No. of cycles If the load is repeated cyclically, enter the number of the repetitions.

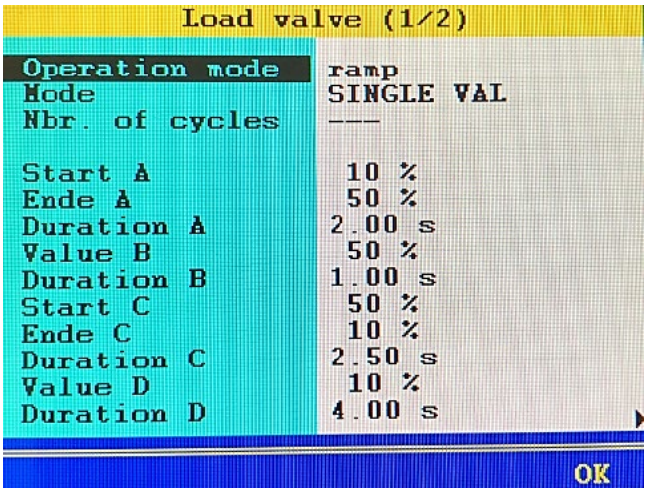
Programming the operating mode manual

In this operating mode it is not necessary to program additional parameters.

In manual mode, the position of the proportional valve is set by pressing the function keys F3 F4 while the load valve is in operation.

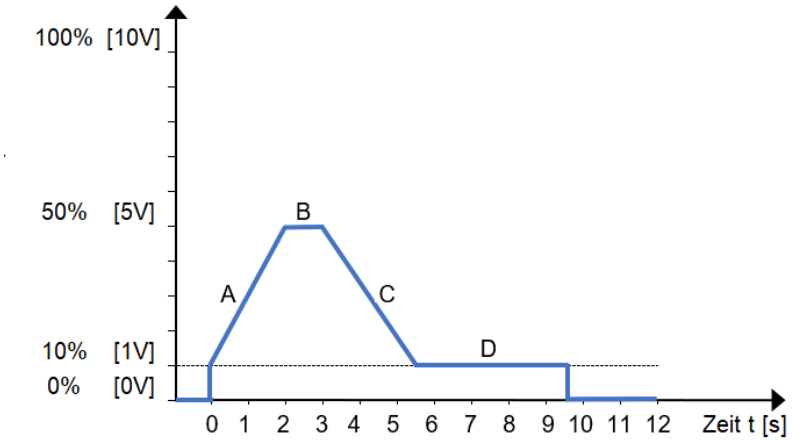
Save and exit the setting with F5 OK .

Programming the operating mode ramp



In this operating mode a ramp, devided in four stages, can be defined.

The values shown in above dialog results in this ramp:



Range A: Rising edge from **start value A** to **end value A** in time **duration A**.

Range B: Level B with **value B** and the dwell time **duration B**

Range C: Falling edge from **start value C** to **end value C** in time **duration C**

Range D: Level D with **value D** and the dwell time **duration D**

Range	Starting value	Final value	Duration
A	10%...100%	10%...100%	0,01…10s
B	10%...100%	10%...100%	0,01…99,99s
C	10%...100%	10%...100%	0…99,99s
D	10%...100%	10%...100%	0…99,99s

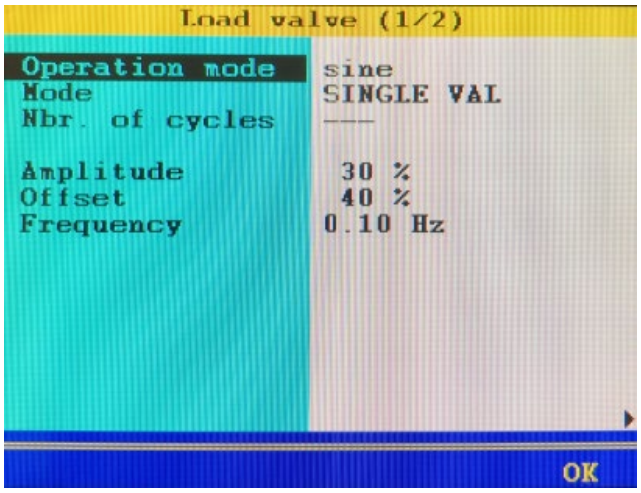
After range "D" has expired, the proportional valve is set to 0V or 0%.

In cyclic mode, the system jumps to the start value "A" after range D. A maximum of 9999 cycles can be run.

Highlight the setting values of the curve, press and ENT enter the desired value and confirm with ENT.

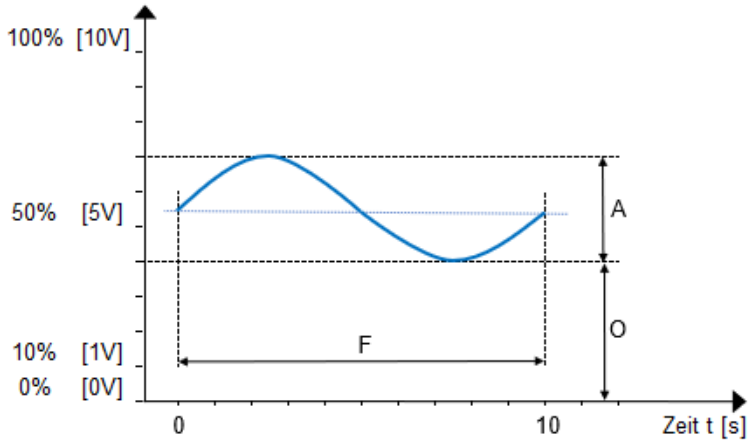
Save and exit the setting with F5 OK.

Programming operating mode sine wave



In this operating mode a sinusoidal curve, devided in three stages, can be defined.

The values in the shown dialog result in this sine wave:



A **amplitude of** the oscillation and corresponds to the Volt value as a percentage of the maximum output voltage.

O **Offset** between zero and the baseline of the oscillation and corresponds to the Volt value as a percentage of the maximum output voltage.

F **Frequency of** the oscillation - is given as a multiple of 10 mHz

Range	Value range
A	10%...100%
O	10%...100%
A+O	max. 100
F	0.01Hz... 2Hz...

A minimum offset of 10% is specified in this operating mode. The amplitude of the sine is added to the offset. The value of 100% is not exceeded, nor is the value falling below 0%.

Make sure that the sum of **amplitude** and **offset** is less than 100%. A negative amplitude cannot be displayed.

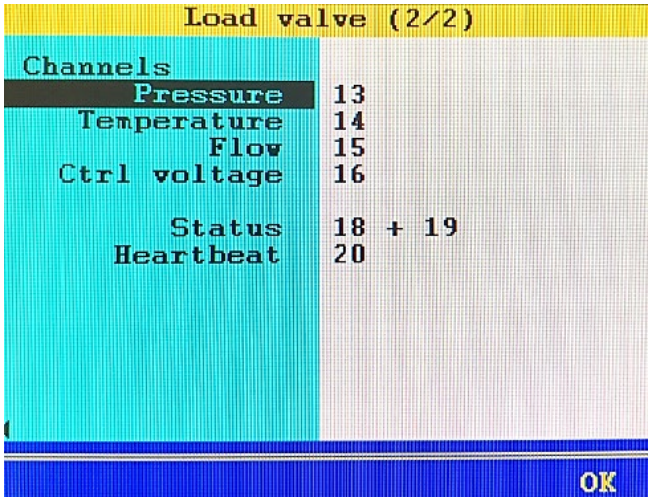
Highlight the setting values of the curve, press and ENT enter the desired value and confirm with ENT.

Save and exit the setting with F5 OK .

Programming channels

If further CAN sensors are integrated into the CAN bus and it becomes necessary to reassign the channels of the load valve, then proceed as follows

Press ◁▷ to display the second dialog box **Load valve (2/2).**



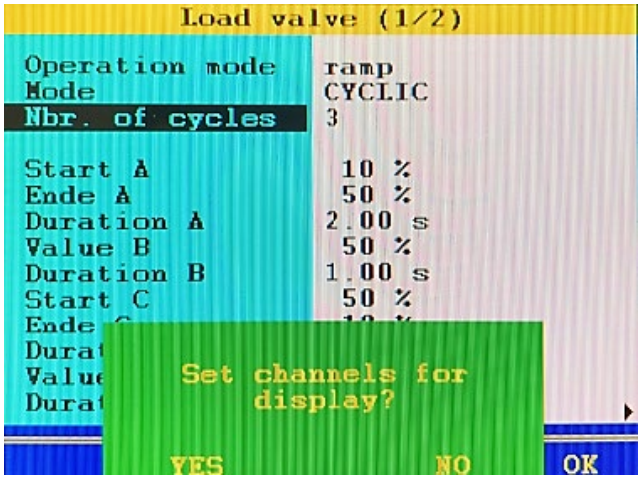
Seven channels are required to operate the load line.

1 Highlight the desired channel,
2 Press ENT and change the channel number.
3 Confirm the entry with ENT .

Save and exit the setting with F5 OK

Exit programming

Press F5 OK to exit the programming of the load valve and to save your entries.



If the channels of the load valve are not shown in the measurement display, the measuring instrument offers to add the channels to the display.

F2 **YES** The measured values of the load valve are inserted into the measurement display.

F4 **NO** The measurement display is not adjusted.

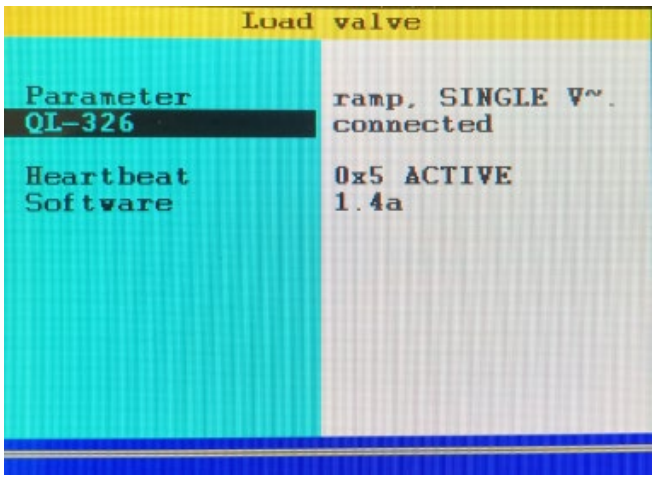
Operate the load valve

The following requirements must be met before you can operate a load valve with the measuring instrument:

- The load valve is connected to the measuring instrument and ready for operation.
- Active communication between the measuring instrument and the load valve.

  A **heartbeat** is displayed.
- The load distance is programmed.

Activate load valve



1 Press MENU to open the menu.

2 Use △▽ to highlight **Special Applications** and press ENT .

3 Use △▽ to highlight **QL-326** (device) and press ENT .

Connected is displayed next to the **QL-326** entry.

4 Press ESC repeatedly until the measurement display appears

The function bar at the bottom of the measurement display, has a double assignment - this can be recognized by two arrows on the right-hand side of the screen.

Press △▽ to switch between the assignments:

In the **operating mode ramp and sine** the commands **START** and **STOP** appear on the function bar

In the **operating mode manual**, the commands **START** and **STOP** and a status display appear on the function bar

The special function bars contain the following functions:

F1 **START** Starts the load valve.

Yellow: The loading section can be started.
Green: The load valve has started and is running.

F2 **STOP** Stops the load valve. The valve of the load valve is opened and the full flow rate flows through the load valve.

Yellow: The load valve has started and can be stopped.
Red: The load section has not started. The key has no function.

F3 Set the position of the proportional valve – **decrease the flow** restriction (only in operating mode manual)

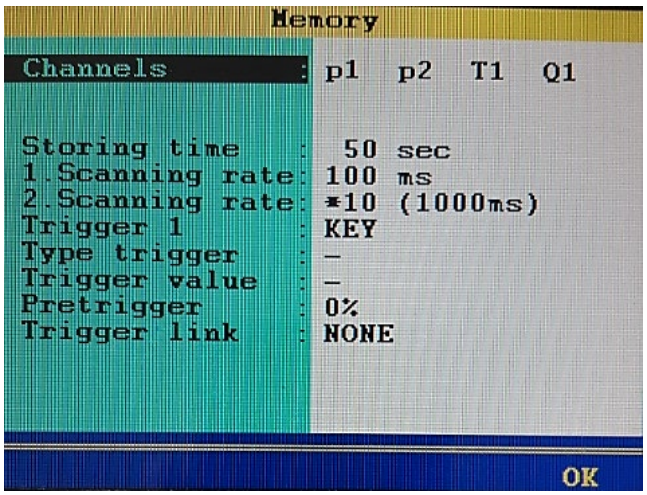
F4 Set the position of the proportional valve – **increase the flow** restriction (only in operating mode manual)

F5 **STOP** Freezes the measurement display.

When you have finished your measuring, you can deactivate the load valve again.

Saving measurement results

To save measured data, use the submenu Memory in the **MultiSystem 5060** *Plus.*



1. Select the used CAN channels for storage.
2. Define additional channels for storage, if necessary.
3. Define the storage time and the sampling rate.
4. When using the load valve, the use of **Trigger 1** with the corresponding **trigger value** is useful and helpful.

Further information on the topic of storing, formatting and displaying measurement data and series can be found in the operating manual of the **MultiSystem 5060** *Plus.*

5 OPERATION WITH MS 5070

With the **MultiSystem 5070,** you can program the electronically controlled load valve **HySense QL 326** and operate it in various operating modes.

Activating the CAN-BUS

Start the **MultiSystem 5070** and activate the **CAN #1 bus** in the menu "Connections". Set the baud rate to 125kBit/s. With F5 (OK) you leave the menu.

1 Press MENU to open the menu.

2 Use △▽ to highlight **Setting** and press ENT .

3 Use △▽ to highlight **Device** and press ENT .

4 Use △▽ to highlight **Connections** and press ENT .

5 Use △▽ to highlight **CAN #1** and press ENT .

6 Use △▽ to highlight **Interface** and press ENT t**ACTIVE.**

7 Use △▽ to highlight **Power Supply** and use △▽ and ENT to switch to **OFF**.

8 Use △▽ to highlight **Bus termination** and press ENT and switch to **YES**.

9 Use △▽ to highlight **Baudrate** and press ENT and switch to **125kBit/s**.

10 The **Start CANopen** entry is not relevant for the operation of the load valve.

11 Exit folder using F5 .

Starting the application Load valve

Select the menus "Extras", "Special applications" always open the menus by selecting ENT . Select the menu "Load valve".

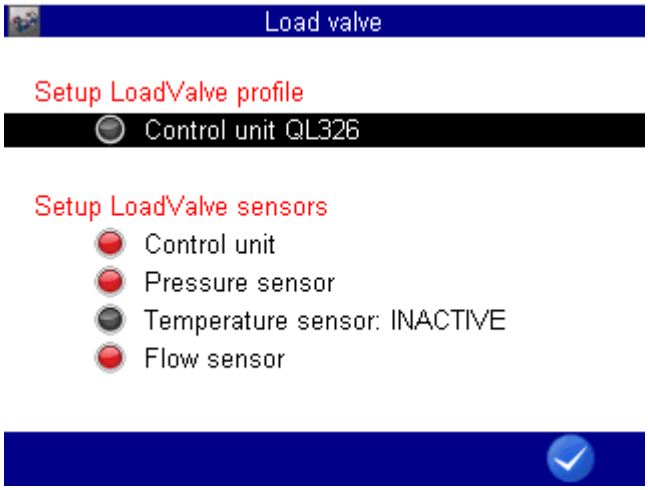
1 Press MENU to open the menu.

2 Use △▽ to highlight **Extras** and press ENT .

3 Use △▽ to highlight **Special Applications** and press ENT.

4 Use △▽ to highlight **Load valve** and press ENT.

You are now in the "Load valve" application.



Setting Load distance

Control unit is inactive - button color **grey**.

The test sequence is set at this point. You can choose between manual, ramp or sine, or activate the load valve - button colour **green**.

Setting QL326 Sensors

This is where the sensor settings are made. The control unit, pressure sensor and volume flow sensor are always available in the standard version. The temperature sensor is not included in the standard product. It can be ordered optionally. The temperature sensor must be activated first.

Control unit, pressure sensor and volume flow sensor are not known yet - button colour **red**.

The temperature sensor is inactive - button colour **grey**.

Sensors whose settings are already known but cannot be found on the CAN bus have the button color **yellow**.

Note: Set parameters are saved when you exit the current window with F5 .

Setting Load profile

The profile of the test sequence can be set here.

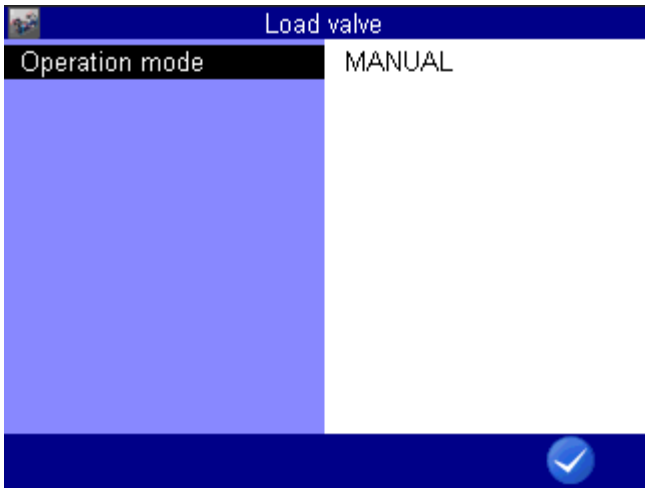
You can choose between manual, ramp or sine respectively set the function of the load valve to INACTIVE.

Note: You can only program the load valve if button color is **grey** - INACTIVE

You can define the operation modes in the **Load valve** dialog.

1 Use △▽ to highlight **Control unit QL326** and press ENT.

Programming the operating mode MANUAL

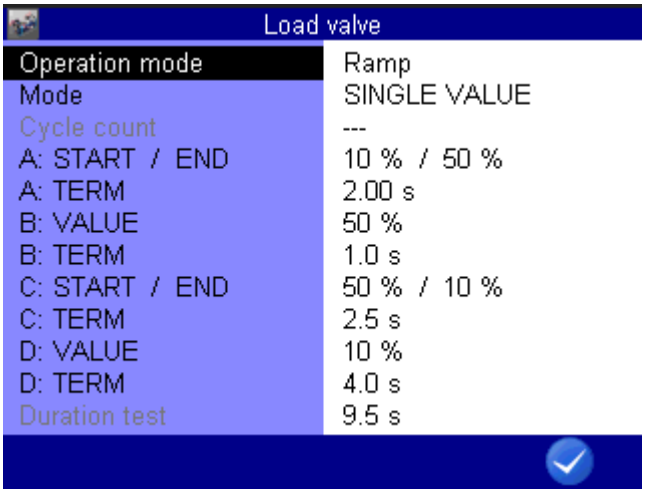


In this operating mode it is not necessary to program additional parameters.

In the MANUAL mode, the position of the proportional valve is set by pressing the function keys during operation of the load valve.

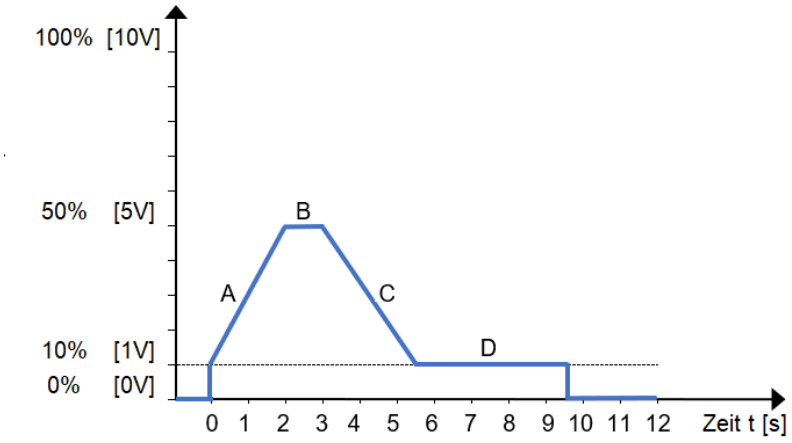
Save and exit the setting with F5

Programming the operating mode Ramp



In this operating mode a ramp, divided in four stages, can be defined.

The values shown in above dialog results in this ramp:



Range A: Rising edge from **start value A** to **end value A** in time **duration A**.

Range B: Level B with **value B** and the dwell time **duration B**

Range C: Falling edge from **start value C** to **end value C** in time **duration C**

Range D: Level D with **value D** and the dwell time **duration D**

Range	Starting value	Final value	Duration
A	10%...100%	10%...100%	0,1…100s
B	10%...100%	10%...100%	0,1…300s
C	10%...100%	10%...100%	0…100s
D	10%...100%	10%...100%	0…20s

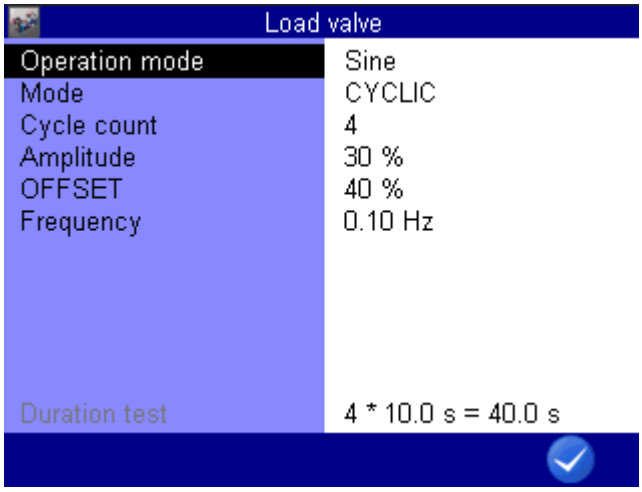
At the end of phase "D" the proportional valve is set to 0V or 0%.

In cyclic mode, the system jumps to the start value "A" after range D. A maximum of 9999 cycles can be run.

Highlight the setting values of the curve, press and ENT enter the desired value and confirm with ENT.

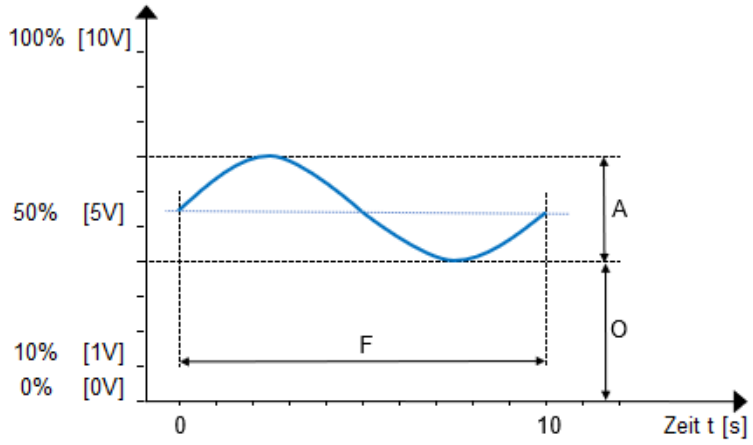
Save and exit the setting with F5.

Programming the sine wave operating mode



In this operating mode a sinusoidal curve, divided in three stages, can be defined.

The values in the shown dialog result in this sine wave:



A **amplitude of** the oscillation and corresponds to the Volt value as a percentage of the maximum output voltage.

O **Offset** between zero and the baseline of the oscillation and corresponds to the Volt value as a percentage of the maximum output voltage.

F **Frequency of** the oscillation - is given as a multiple of 10 mHz

Area	Value range
A	10%...100%
O	10%...100%
A+O	max. 100
F	0.01Hz... 2Hz...

A minimum offset of 10% is specified in this operating mode. The amplitude of the sine is added to the offset. The value of 100% is not exceeded, nor is the value falling below 0%.

Make sure that the sum of **amplitude** and **offset** is less than 100%.
A negative amplitude cannot be displayed.

Highlight the setting values of the curve, press and ENT enter the desired value and confirm with ENT.

Save and exit the setting with F5

Setting QL326 Sensors

When using the load valve for the first time, the connected sensors are still unknown. The temperature sensor is always set **INACTIVE.**

If a temperature sensor is used, it is useful to activate it before scanning the CAN bus.

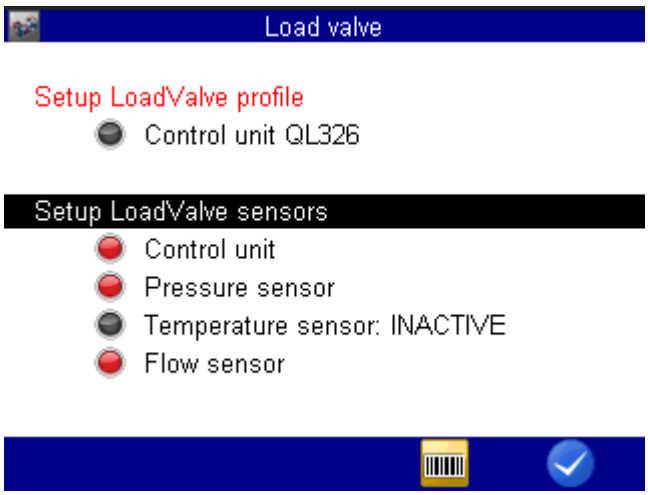
Proceed as follows:

1. Use △▽ to highlight **Temperatur sensor** and press ENT .
2. Use △▽ to highlight **Temperature sensor** and confirm with ENT to **YES**.
3. Leave the setting with F5 .

It is also possible to add a temperature sensor at a later date. For this purpose, the CAN bus can be scanned with F1 . The found sensor will be entered automatically.

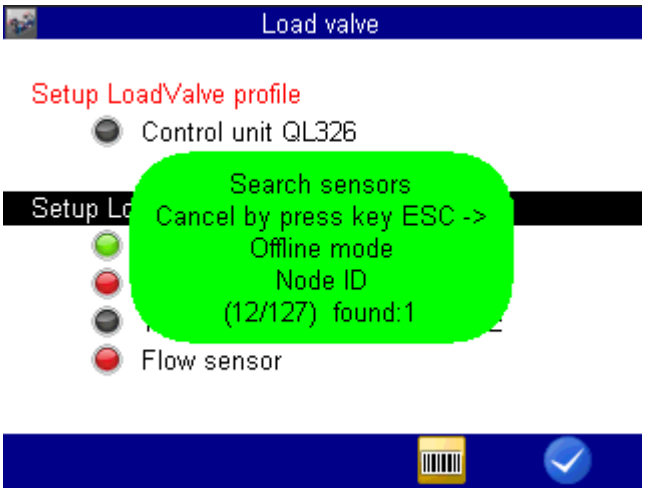
Scan CAN bus

Scan the CAN bus for connected sensors of the load valve.



1 Use △▽ to highlight **Setup LoadValve Sensors**

2 Press F4 and scan the CAN bus.



3 Leave the setting with F5 .

Detected sensors are configured directly and the button colour changes to **green**.

Detection of multiple sensors on the CAN bus

The first found sensor is pre-installed, if more than one sensor of one measurement variable are detected. The button colour shows **yellow**. In the submenu of the sensor a selection field is displayed to select the right sensor. In this case it may be necessary to change the channel and node ID of the sensor found.

The control unit is permanently pre-programmed. Only the channel number can be exchanged.

For pressure, temperature and volume flow sensor the measuring channel can be changed and the Node-ID of the sensor can be selected.

To change the channel number and Node-ID, proceed as follows:

1 Mark the△▽ desired sensor and press ENT .

2 Use △▽ to highlight **channel** and press ENT .

3 Select the desired channel from the channel list and press ENT to accept.

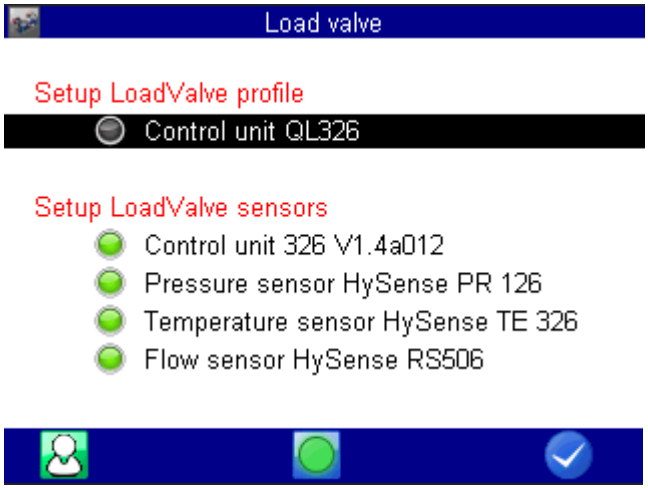
4 Use △▽ to hightlight **Node ID** and press ENT .

5 Select the desired Node-ID from the ID list and press ENT to accept.

6 Save and exit the setting with F5 .

Activation QL326

When all relevant traffic lights of the sensor system are "GREEN", the load distance can be activated.



ONLINE / OFFLINE - Mode

Switches the load valve to the ONLINE mode. The button colour of the control unit changes to **green**. A correction of the parameters is no longer possible.

F5 takes you directly to the menu of the measured value display. All active sensors are added to the display indication. A manual correction is possible later. In the measured value display, you have an additional softkey bar for sequence control of the load valve.

Switches the load valve to the OFFLINE mode. The button colour of the control unit changes to **GREY**. The correction of parameters is possible again.

Storing measured values

or The function key F1 switches between both states.

When starting a test cycle, the storage is automatically activated.

When starting a test cycle, the storage is not automatically activated. You must set up a storage yourself.

When leaving this menu with F5 the required storage time is calculated from the current parameter settings and all active sensors of the load valve are added to the display.

The display can be adjusted manually via the channel settings.

Measured value display

The measured value display shows all active sensors with their current measured values. The structure of the measured value display is the same for all operating modes.

A softkey bar is located at the bottom of the screen. Here you will find commands to start the set operating mode, to change the display format, to call up the last measurement and to return to the load valve.

In the ONLINE mode of the load valve, another softkey bar is available, which can be reached with the cursor △▽ keys.

Note: It is not possible to add your own favourites to the softkey bar for the load valve.

Switches the display mode List, Tiles, Graphics, MINMAX

The test cycle gets started.

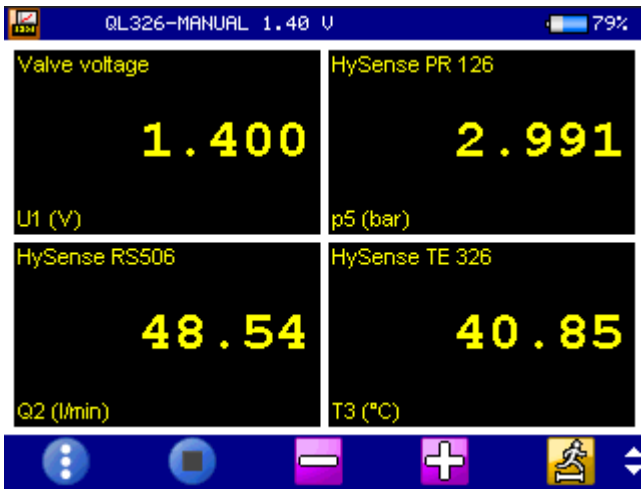
Recalling the last measurement

Return to the load distance menu

Switching between the softkey bars is possible with the "UP" and "DOWN" cursor keys.

Start test cycle Manual

In the manual mode the load valve can only be controlled by manual input. After starting the test cycle with F2 the desired valve voltage can be set with F3 and F4 .Any number of measuring channels can be added to the measured value display.



Switches the display mode List, Tiles, Graphics, MINMAX

The test cycle is terminated.

Reduce the control voltage

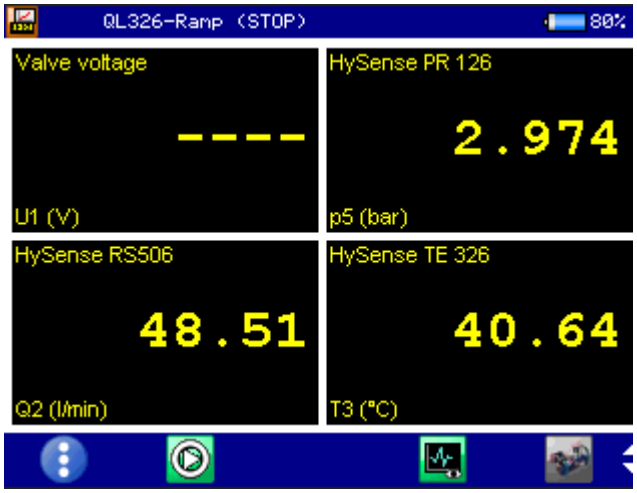
Increasing the control voltage

Note: The control voltage can be set between 0V...10V. This display corresponds to the load value 0%...100%.

changes the step size per step

Start test cycle Ramp or Sine

The selection of functions on the softkeybar is reduced in the operating mode ramp or sine.



Switches the display mode List, Tiles, Graphics, MINMAX

Start the test. The test cycle is activated and processed automatically. In the case of cyclic repetition, the current executed cycle is displayed in the header

Return to the Load Distance menu.

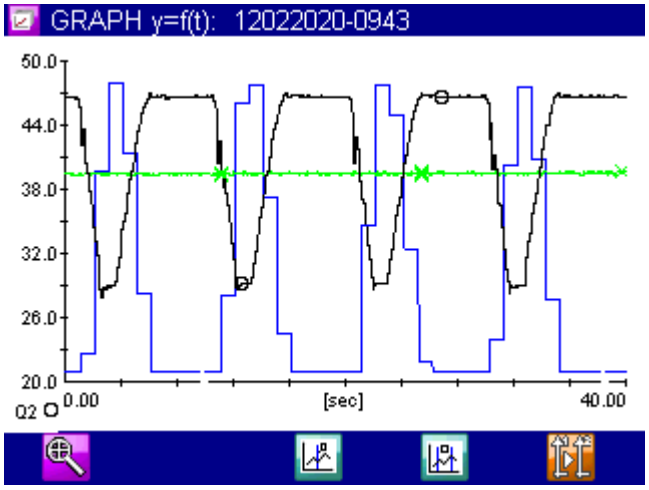
After starting the test cycle the measurement display is supplemented by the test progress bar and the numbers of cycles completed.

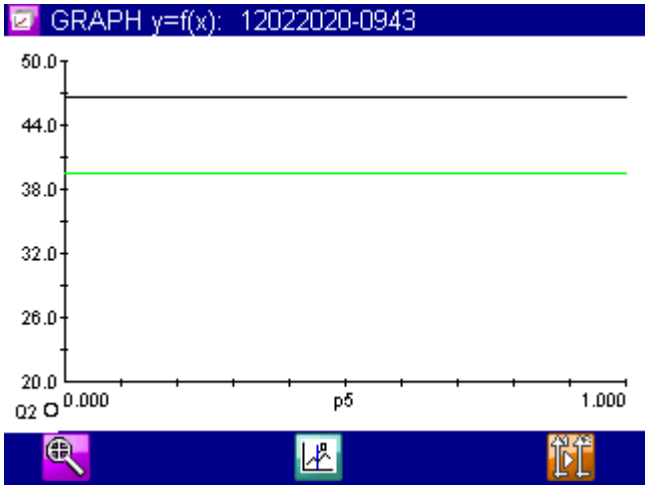
The test cycle is terminated prematurely.

Display of the storage

Various displays of the measurement results are available after the test cycle. For a better overview, all channels can be formatted accordingly.

The graphic representation of measuring channels over time as well as the representation of measuring channels over a defined measuring channel are possible.





Enlargement of the section

Inserting measuring spots

Change of the measuring channel display of the Y-axis

6 CONTROL WITH CAN COMMANDS

The load valve can be fully controlled via the CAN bus.

Various data are defined and transmitted to the control box via CAN bus. The load valve is able to follow a pre-defined load curve (ramp or sine). In addition, it is possible to process the load curve cyclically, i.e. identical loads can be run several times in succession.

CAN - Setup

Baud rate: 125 kB (not changeable)

Node ID: 0x20 (cannot be changed)

TPDO1: 0x1A0 Valve voltage

TPDO2: 0x2A0 Status information

Heartbeat: 0x720 (every 1000ms) DLC=8

Heartbeat

The current operating mode is transmitted in byte [0]

0x02: Configuration parameter not loaded

0x03: Calibration data for DAC not set

0x04: Standby (OFFLINE)

0x05: Connected (ONLINE: Parameter are activated, waiting for START)

0x06: Activated (LoadValve is running)

0x07: ConfigMode active

0x80: TimeoutCounter

In operating mode "2", and "4" the firmware version is transmitted as ASCII text in Byte [1..7]
.B. "1.4 011".

The operating mode can be queried specifically via object 0x2050/1.
Answer: 4 Bytes:
Byte [0]: Operating mode

CAN commands in SDO and QL326 protocol

SDO protocol

Object	SubIndex	Data type	Description	Answer
0x1000	0	RO uint32	Read device identifier	0x316AA000
0x2050	1	RO uint32	Read Heartbeat, TimeoutCounter is reset in the control box	

QL326 Protocol

CMD	Parameters	Description / Answer (Rx)
0x02	uint8_tuint16_t uint16_tuint16_t	Ramp values W1 (e.g.: Tx: 02 00 64 00 F4 01 F4 01) 0x00start value A in 10mV steps (100 => gives 1.0V as start value)End value A in 10mV stepsstart value C in 10mV stepsRx: 40 02 00 <xxx>
0x03	uint8_tuint16_t uint16_tuint16_t	Ramp values Z1 (e.g.: Tx: 03 00 C8 00 64 00 F4 00) 0x00Duration A in 10ms steps (200 => gives 2.0 seconds) Duration B in 10ms stepsDuration C in 10ms stepsRx: 40 03 00 <xxx>
0x04	uint8_tuint16_t uint16_tuint16_t	Ramp values W2 (e.g.: Tx: 04 00 64 00 F4 01 64 00) 0x00Final value C in 10mV steps (100 => gives 1.0V as start value)Constant Bin 10mV stepsConstant D in 10mV stepsRx: 40 04 00 <xxx>
0x05	uint8_tuint16_t uint16_tuint16_t	Ramp values Z2 (e.g.: Tx: 05 00 90 01 00 00 00 00) 0x00Duration A in 10ms steps (200 => gives 2.0 seconds) Duration B in 10ms stepsDuration C in 10ms stepsRx: 40 05 00 <xxx>
0x06	uint8_t uint8_t uint8_tuint8_tuint8_tuint16_t	Operating mode (e.g.: Tx: 06 04 31 03 01 00 05 00; Sine, Cyclic, 5 cycles) 0x040x31mode (0x01=Manual, 0x02=Ramp, 0x03=SineCyclic (0x00=SINGLE, 0x01=CYCLIC0x00Number of cycles
0x07	0x00	Switch ControlBox to StandbyModeRx : 40 07 00 00 00 00 00
	0x01	Switch ControlBox to ConnectModeRx : 40 07 01 00 00 00 00 00
0x08	0x01	Start test procedureRx : 40 08 01 00 00 00 00 00 00
	0x02	Stop test sequenceRx : 40 08 02 00 00 00 00 00
0x10	uint8_tuint16_t uint16_t uint16_t	Sine values (e.g.: Tx: 10 00 2C 01 0A 00 90 01) 0x00Amplitude 10mV steps (300 => gives 3.0V) Frequency in 10mHz steps (10 => 0.1Hz) Offset in 10mV stepsRx : 40 10 00 <xxx>

0x55	0x01	Read status QL-TypeByte [4] = Operating modeRx : 40 55 01 00 02 33 32 36 ("326")
	0x02	Read status firmware versionRx : 40 55 02 00 31 2E 33 61 (firmware version 1.3a)
0x60	0x99	Save ConfigurationRx : 60 99 00 00 00 00 00
0x79	uint8_tuint16_tuint8_t uint32_t	SingleStep (e.g.: Tx: 79 03 01 00 00 00 00 00) 0x03Valve value in 10mV steps0x000x00Rx : 40 79 03 01 00 00 00 00
0x99	0x01	Parameter CONFIG ONRx : 40 99 01 00 00 00 00
	0x02	Parameter CONFIG OFFRx : 40 99 02 00 00 00 00
	0x03	Parameter CALIBRATION ONRx : 40 99 03 00 00 00 00
	0x04	Parameter CALIBRATION OFFRx : 40 99 04 00 00 00 00
0xAA	0x01	Reset control box

Query of the control box

5A0h	8	42 00 10 00 00 A0 6A 31
620h	8	40 00 10 00 00 00 00 00

The control box reports with the Product-ID: 0x316AA000

Example for control via CAN

- Read QL Type ("QL326")
  Command 0x55 0x01...
- Read the heartbeat status (Byte[0]) 0x02 means ControlUnit is not configured.
- Read firmware version
  Command 0x55 0x02...
- Activate Send parameters ONCommand
  0x99 0x01
- Send all parameters to control box (ramp and sine)
  Param W1Param
  Z1Param
  W2Param
  Z2Param
  Sine
- Memory Parameters
  Command 0x60
- Param Operating mode
  Command 0x06
- Activate send parameters OFF
  Command 0x99 0x02
  HeartbeatState must now be sent 0x04.
- Send Connect to control box
  Command 0x07 0x01HeartbeatState
  0x05 must now be sent.
- Start test sequence

  Command
  NOTE: The control box now works with a timeout which is counted up internally. This timeout must be reset at least every 1000ms via CAN command (0x2050/1), otherwise the control box switches itself off and ends the test cycle.

  Tx: 0x40 50 20 01 00 00 00 00
  Rx: 0x43 50 20 01 05 00 00

  HeartbeatState must now be sent 0x06.

Operating mode Ramp / Sine

The test cycle runs continuously until all cycles have been processed or the STOP command is sent manually.

HeartbeatState must then be sent 0x05 again.

Manual operating mode

The desired valve value is sent.

Command 0x79

End test cycle

Command 0x08 0x02

Heartbeat state must be sent 0x05 again afterwards.

Example for programming and starting with CAN commands

The controller has three different modes:

- calibration
- configuration
- operation

Calibration

The control boxes are usually delivered calibrated.

Activate calibration mode

Send this CAN message to start the calibration mode:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	99h	03h	00	00	00	00	00	00

The calibration mode is confirmed every five seconds by a heartbeat message:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x720	8	77h	00	00	00	00	00	00	00

Calibrate zero value of channel 1

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	77h	01h	01	00	00	00	00	00

The D/A output is set to 0 V. To get the actual digital value for the zero point, the message must be repeated until the DVM at the terminal output moves out of the zero point. With the following message the AD value is decremented again so that the exact zero point can be determined:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	77h	01h	00	00	00	00	00	00

Once the zero point has been set, confirm this with the message:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	77h	01h	03	00	00	00	00	00

The zero value of channel 1 is now stored in the device.

Calibrate end value of channel 1

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	77h	02h	01	00	00	00	00	00

The D/A output is set to 0 V. To get the actual digital value for the final value, repeat the message until the DVM displays 10 V DC at the terminal output. With the following message the AD value is decremented again so that the exact final value can be determined.

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	77h	02h	00	00	00	00	00	00

Once the final value has been set, confirm this with the message:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	77h	02h	03	00	00	00	00	00

The end value of channel 1 is now stored in the device.

Calibrate zero and full scale value of channel 2

Perform the same procedure for channel 2 as for channel 1. Replace 0x78 in the CAN messages for byte B0.

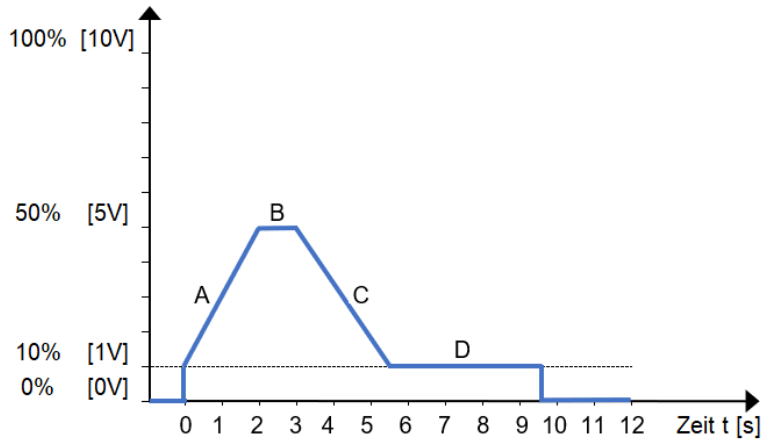
End calibration

Send this CAN message:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	99h	04h	00	00	00	00	00	00

Setting a ramp load

You can set an individual load curve in the form of a ramp:



Range A: Rising edge from **start value A** to **end value A** in time **duration A**.

Range B: Level B with **value B** and the dwell time **duration B**

Range C: Falling edge from **start value C** to **end value C** in time **duration C**

Range D: Level D with **value D** and the dwell time **duration D**

Range	Starting value	Final value	Duration
A	10%...100%	10%...100%	0,1…100s
B	10%...100%	10%...100%	0,1…300s
C	10%...100%	10%...100%	0…100s
D	10%...100%	10%...100%	0…20s

Switch to configuration mode

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	99h	01h	00	00	00	00	00	00

Select operating mode

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	01h	XXh	00	00	00	00	00	00

For byte B1, enter one of the following numbers instead of XX:

0x00individual ramp (ramp is run once, then the device stops)
0x01cyclic ramp (ramp is run down and repeated until the stop command is sent)
0x02off , no activity

Programming values and times

Start and end values ramp A, start value ramp C:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	0x02		Start ALSB	Start AMSB	End ALSB	End AMSB	Start CLSB	Start CMSB

Duration Ramp A, Duration B, Ramp C:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	0x03		Duration ALSB	Duration AMSB	Duration BLSB	Duration BMSB	Duration CLSB	Duration CMSB

End value ramp C, values Duration times B and D:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	0x04		End CLSB	End CMSB	Value BLSB	Value BMSB	Value DLSB	Value DMSB

Duration time D:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	0x05		Duration DLSB	Duration DMSB	00	00	00	00

Save configuration

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	80h	00h	00	00	00	00	00	00

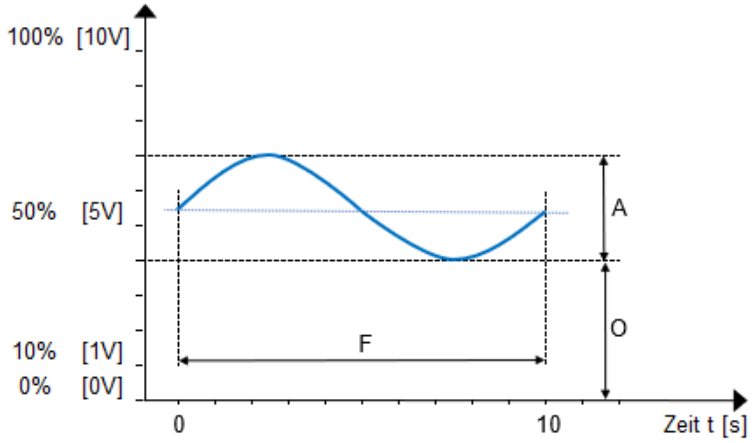
The parameters are saved and remain until the next configuration.

End configuration

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	99h	02h	00	00	00	00	00	00

Setting a sinusoidal load

Besides the ramp, you can also program a sinusoidal load:



A **amplitude of** the oscillation and corresponds to the Volt value as a percentage of the maximum output voltage.

O **Offset** between zero and the baseline of the oscillation and corresponds to the Volt value as a percentage of the maximum output voltage.

F **Frequency of** the oscillation - is given as a multiple of 10 mHz

Area	Value range
A	1…10V
O	1…10V
A+O	10V
F	0.01Hz...2Hz in 10nHz steps

A minimum offset of 10% [1V] is specified in this operating mode. The amplitude of the sine is added to the offset. The value of 100% [10V] is not exceeded, nor is the value falling below 0% [0V].

Make sure that the sum of **amplitude** and **offset** is less than 100% [10V].
A negative amplitude cannot be displayed.

Switch to configuration mode

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	99h	01h	00	00	00	00	00	00

Select operating mode and define sine wave

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	10h	xxh	yyh	yyh	zzh	zzh	vvh	vvh

Replace the placeholders in the bytes with these commands:

Byte B1 (xxh)	0x01Sine On0x02Sine Off
Bytes B2 and B3 (yyyyh)	Amplitude in multiples of 10 mV, LSB first
Bytes B4 and B5 (zzzzh)	Frequency in multiples of 10 mHz, LSB first
Bytes B6 and B7 (vvvvh)	Offset in multiples of 10 mV, LSB first

Save configuration

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	80h	00h	00	00	00	00	00	00

The parameters are saved and remain until the next configuration.

End configuration

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	99h	02h	00	00	00	00	00	00

Starting and stopping the control box

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
0x620	8	00h	xxh	00	00	00	00	00	00

Replace the xx in byte B1 with the desired command code:

0x01Start for ramp
0x02Stop for ramp
0x03Start for sine
0x04Stop for sine

Status of the heartbeat

The control box indicates its status via the heartbeat:

ID	DLC	B0	B1	B2	B3	B4	B5	B6	B7
720	8	XXh	00	00	00	YY	YY	YY	YY

The following states are defined:

XX = 0x04 Device is stopped
XX = 0x05 Device is started
XX = 0x7F Control box in configuration mode
XX = 0x77 Control box in calibration mode
YY Firmware version in ASCII format

7 ACCESSORIES

Please use only spare parts and accessories from Hydrotechnik.

Product	Order no.
CAN cable - 5m for connection to the MultiSystem 5060 Plus and MultiSystem 5070	8824-R7-05.00
CAN cable - 2,5m for connection to existing CAN bus, e.g.	8824-N3-02.50
Power supply unit	8812-00-00.27
Temperature sensor HySense TE 326, CAN, M12 5p m, 0…+150°C, G1/4 Form E HySense TE 300, 4…20mA, M16 6p m, -50…+200°C, G1/4 Form E	 3408-53C0-G213C01 3408-23C0-G231Z1S

8 ERROR PICTURES

Possible error patterns, their causes and appropriate measures to rectify them are listed below.

Error Pattern	Possible Cause	Action
Strong vibrations	Insufficient venting	Vent the system
Flow rate drops too early	Malfunction of the control unit	Disconnect control unit from power and restart
Sensors not detected / missing after scanning	Incorrect node ID	Assign new node ID
	Cable break	Replace component

Cleaning

Attention

Damage to the device possible!

Switch off and disconnect the load from the power supply before starting cleaning. Otherwise, a short circuit may occur, which may cause serious damage to the unit.

Attention

Damage to the device possible!

Never use aggressive cleaning agents, solvents, benzine or similar chemicals to clean the device. Otherwise, the housing will be damaged.

- If the housing is dirty, wipe it with a soft, slightly moistened cloth.
- Hard stains can be removed with a mild household cleaner.

Calibration and maintenance

This device operates maintenance-free. However, it is necessary to have it calibrated regularly. We recommend calibration every two years if the instrument is used frequently. Please send the instrument, freight prepaid and securely packed, to our customer service centre (see address below).

Repair

In case of repair please contact our customer service. Please have the following information ready before contacting us. If you are sending in the unit, this information should also be included:

- Company
- Department
- Contact person
- address
- Telephone and fax number
- E-Mail address
- Contested part (device, sensor, cable)
- PC used (CPU, clock frequency)
- operating system (Windows 95/98/SE/2000/NT/XP/Vista/Win7, others)
- HYDROcom Software Version
- Fault description (leave the settings on the device and at the time of the fault; briefly describe your measuring task, connection of the sensors, device settings)