

# Single line and progressive lubrication system controller

Model 86535



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# Explanation of safety signals

 **WARNING**

Safety alert symbols identify potential physical injury hazards. Obey all safety messages below this symbol to avoid possible injury or death.

 **SAFETY INSTRUCTION**

Safety instruction sign indicates specific safety-related instructions or procedures.

 **DANGER**

Indicates hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING**

Indicates hazardous situation which, if not avoided, may result in death or serious injury.

 **CAUTION**

Indicates hazardous situation which, if not avoided, could result in minor or moderate injury.

# Safety

Carefully read and observe operating instructions before installing and operating controller.

 **WARNING**

Controller must only be installed, maintained, and repaired by persons familiar with these operating instructions.

Do not attempt to install, use, or troubleshoot prior to fully understanding all safety and operational instructions.

 **Notice**

Local safety regulations regarding installation, use and maintenance must be followed.

# Description

## Functionality

LMC 101 controls both single line and progressive lubrication systems. While designed for off-the-road and mobile equipment use, controller can be used for any low voltage lubrication application.

Several controller features include:

- 12 and 24 V DC systems
- Time or controller mode
- Single line and progressive systems
- Various alarm condition settings, including:
  - cycle frequency
  - alarm triggers
- Programming, data logging, and reporting, including:
  - system resets
  - downloads to controllers
  - lubrication activity
  - lubrication cycles
  - alarms.

Controller must be programmed via USB connection to PC.

## Timer mode

- In **timer** mode, lube cycle ends when pre-assigned time has expired.

## Controller mode

- In **controller** mode, lube cycle ends when pressure switch, pressure transducer, or piston detector actuates.

## Single Line system

In **single line** systems:

- Pressure switches or pressure transducers can be installed at pump and/or end of supply line.
- System allows pressure to dissipate to end of supply line once pressure at pump is reached.

## Enclosure lid

Enclosure lid features:

- Manual lubrication push button.
- Four LEDs:
  - Power on/run
  - Pump on
  - Low level fault
  - System fault (alarm)



### Notice

Use of end of line pressure transducers recommended. Transducers allow for detection of pressurization failures, such as injector cycle and injection venting failure.



### Notice

**Steady** alarm light indicates controller will attempt another lubrication cycle.

**Blinking** alarm light indicates no more lube cycles be attempted until fault is corrected.

Table 1

### Product specification

Input voltage	12 V DC and 24 V DC -20% / +30%
Current consumption	60 ma (less external load)
Pump relay contact	20 A at 30 V DC
Vent relay contact	2 A at 30 V DC
Alarm relay contact	2 A at 30 V DC
Enclosure rating	NEMA 12
Temperature range	-40 to 150 °F (-40 to 65 °C)
Net weight	2 lbs. (0,9 kg)
Off time (adjustable)	15 seconds to 99 hours
On time (adjustable)	15 seconds to 99 hours
Lubrication system	Single line and progressive
Enclosure size	8.25 x 5 x 3.50 in. (20,9 x 12,7 x 8,9 cm)
Mounting dimensions	8.75 x 3.75 in. (22,2 x 9,5 cm)

Table 2

### Parts list

Item no.	Description	Part no.	Quantity
	LMC USB Cable Kit	86505	1

## PC requirements

### Notice

Controller must be connected to a PC that meets these requirements in order to be configured.

### Notice

Do not install or run LMC software on server-level operating systems.

## Requirements

- 1 800 x 600 display (1024 x 768 recommended).
- 2 Keyboard and mouse (or other pointing device).
- 3 USB 2.0 port and standard cable with full size B-type connector
- 4 Microsoft .Net Framework 4.0 client installed.
- 5 50MB of available hard drive space (after .Net 4.0 client installed).

### Notice

If PC does not have Microsoft .Net Framework 4.0 client installed, confirm PC meets these requirements before downloading .Net 4.0 client to PC:

- Processor: 1 GHz
- Memory: 512 MB
- Hard drive: 1.5 GB
- Operating systems:
  - Windows 7
  - Windows 8

If PC meets requirements, visit <http://www.microsoft.com/en-us/download/details.aspx?id=17851> and install .Net software before proceeding.

### Notice

Controller software needs 32-bit version of .Net framework to function. 32-bit version of .Net will operate on 64-bit PCs.

## Software installation

### Notice

Do not install LMC 101 software before confirming computer meets all requirements in **PC requirements** section on **this page**.

- 1 Visit <http://www.lincolnindustrial.com/products/als.aspx> and click link labelled **LMC 101 PC Software**.
- 2 Download PC software installation files from website.
- 3 Follow installation on-screen instructions until installation is successful.

# Controller preparation



## Notice

LMC 101 software must be installed on a PC with a USB port prior to proceeding in this section.

- 1 Disconnect power supply to LMC 101.
- 2 Remove LMC 101 cover to expose printed circuit board.
- 3 Connect USB cable from PC to USB port on circuit board.



## Notice

When USB cable is connected, **Run** and **Power** lights on enclosure lid will light up, with **Run** light blinking.

- 4 Wait for **Run** light to stop blinking before proceeding.
- 5 On PC, double-click LMC 101 software icon.
- 6 Follow instructions in **Controller configuration** section on **page 6** to configure and customize controller.



## Notice

When configuration is complete, remove USB cable from controller and re-attach cover before using controller.

# Controller configuration

**! Notice** LMC 101 can only be configured via USB cable to a PC that meets all **PC requirements** listed on **page 4**.

- 1 From main screen, click **Program Controller** button.

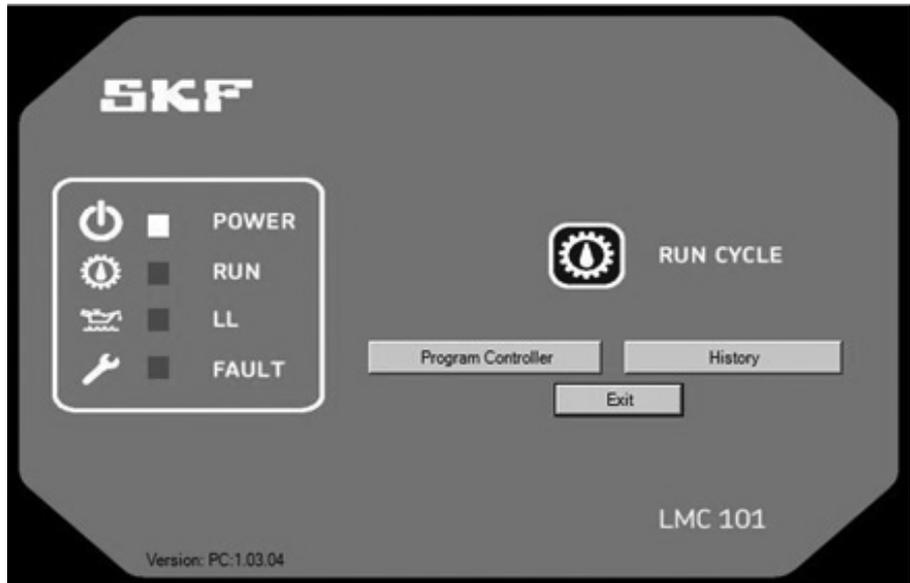


Fig. 1

- 2 LMC 101 configuration window
  - 2.1 In **Customer** field, enter name of your organization.
  - 2.2 In **Location** field, enter either name of your location, name of your department, or other name that will uniquely identify system that will be controlling software.

**! Notice** **Customer** and **Location** fields are stored on PC and on controller. If wanting to track pump history and activity from multiple controllers, determine a naming convention prior to proceeding.

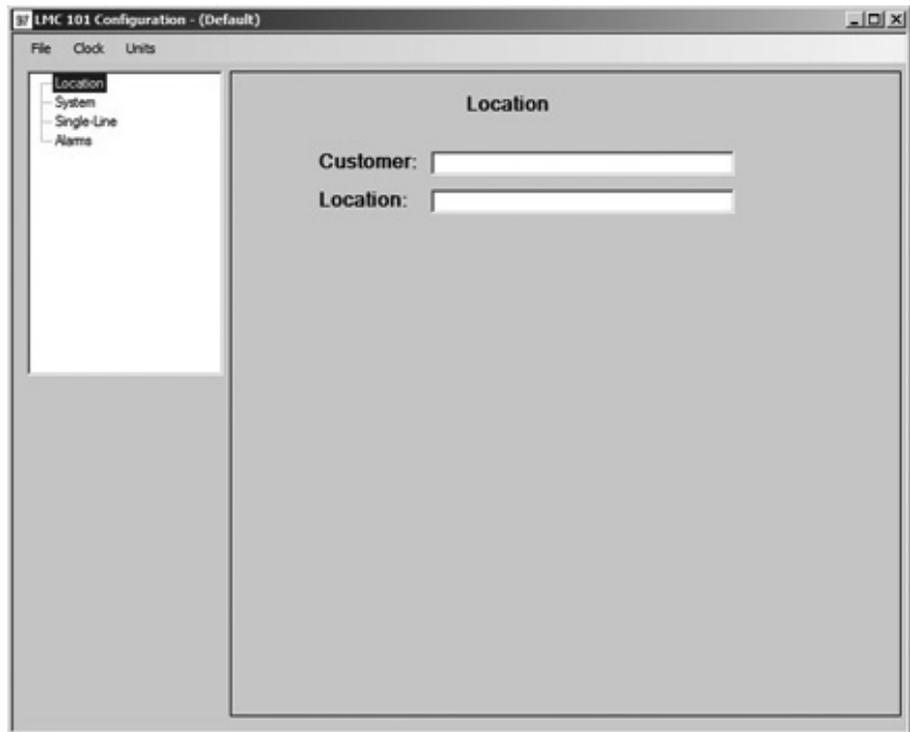


Fig. 2

## Menu bar

3 On menu bar across top of window (fig. 2), three options are displayed - **File**, **Clock**, and **Units**.

3.1 Clicking on **File** displays:

- 3.1.1 **Open file** - allows user to select existing LMC 101 account settings for editing and/or downloading to another controller.
- 3.1.2 **Save file** - creates and/or saves all LMC 101 settings to PC.
- 3.1.3 **From controller** - uploads settings from controller to PC.

### Notice

USB port number must be selected prior to completing step 3.1.3.

3.1.4 **To controller** - downloads selected or saved account settings to controller.

3.1.5 **Exit** - closes **LMC 101 configuration** window.

3.2 **Clock** adjusts controller's internal clock.

3.2.1 Click **sync time to PC** button (fig. 3).

### Notice

Manual adjustment of internal clock is not recommended if historical data tracking is desired.

3.3 **Units** opens a popup window that defines units in English or Metric.

3.3.1 **English** mode will display units in **psi**.

3.3.2 **Metric** mode will display units in **bar**.

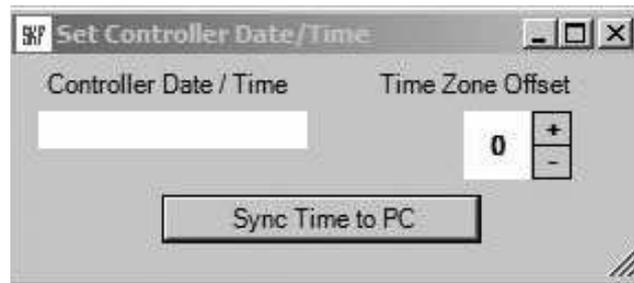


Fig. 3

## Left side menu

In left side menu, four options will be listed - **Location**, **System**, **Single-line**, and **alarms**. **Step 2** on **page 6**, covers default selection **location**.

### 4 System displays:

- 4.1 System type** - drop menu to define system as:
- Single-line, or
  - Progressive

#### **!** Notice

If system is **progressive**, skip to **step 1** on **page 14**.

- 4.2 Pause time** - defines pause time between lubrication cycles.
- 4.3 Maximum pumping time** - defines amount of time each pump will send lubricant.
- 4.4 Prelube mode** - controls pre-lubrication activity (see **step 5** on **page 9**).
- 4.5 Pulse active checkbox** - activates pump pulsing option during pump cycling, as defined by **pulse time interval** text box.
- 4.6 Pulsing time interval** - defines amount of time between pump pulses.

#### **!** Notice

Pulse air flow causes control board vent relays to pulse on and off.

#### **!** Notice

Pulse time controls frequency of pulse air flow.

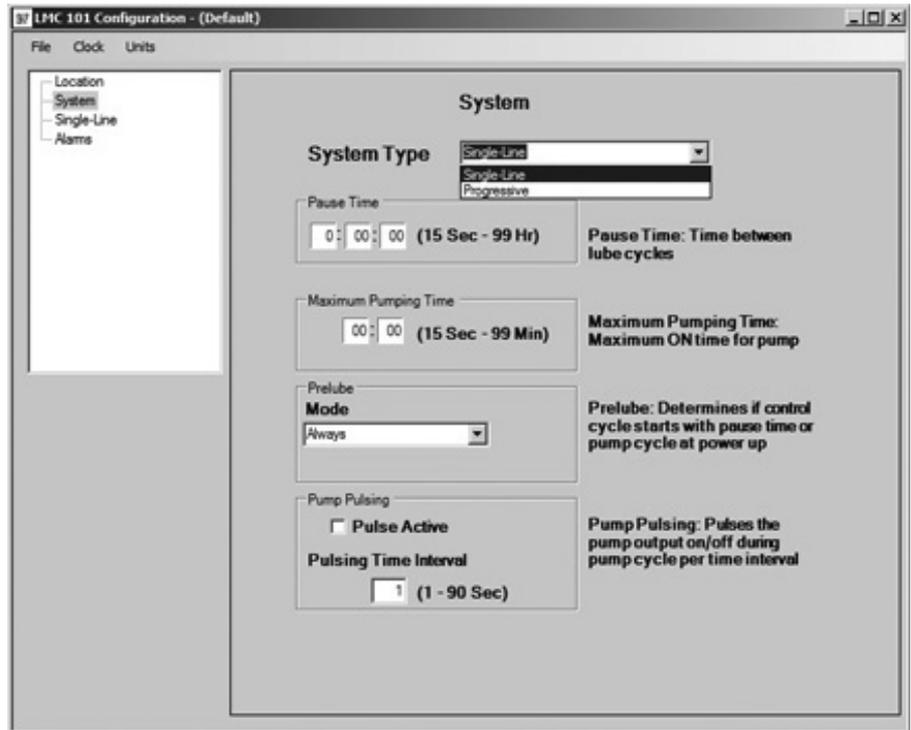


Fig. 4

- 5 **Prelube** drop menu defines lubrication cycling option upon controller power up.
  - **Always** – a prelube cycle will always occur during power up.
  - **After 3hr off** – a prelube cycle will only occur when power has been off for longer than 3 hours.
  - **Never** – a prelube cycle will not occur during power up.
- 6 Clicking on **single line** will display **timer** or **controller mode** radio buttons.

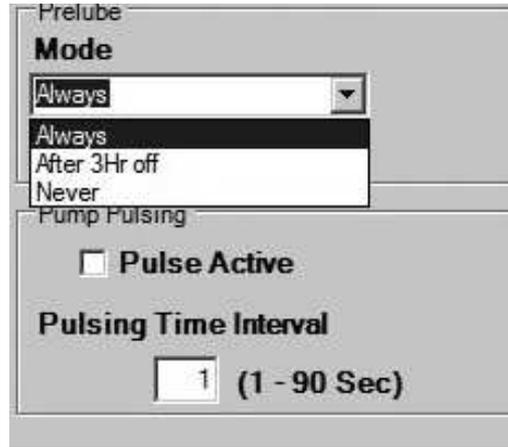


Fig. 5

- 6.1 Options controlled by these radio buttons:
  - 6.1.1 **Timed** – select if using time to control pump activity (if selecting this option, skip to **step 10** on **page 13**).
  - 6.1.2 **Pressure switch** – select if using pressure switch measurement at pump to end lube cycle signal (if selecting this option, proceed to **step 7** on **page 10**).
  - 6.1.3 **Pressure transducer** – select if using transducer pressure measurement at pump to end lube cycle (if selecting this option, skip to **step 8** on **page 11**).



Fig. 6

7 Selecting **pressure switch** radio button activates:

**7.1 End of line** – allows use of a second pressure switch at end of lube supply line to complete lubrication cycle.

**WARNING**

A pressure switch or transducer must still be used at pump in **End of Line** systems to prevent pressure build up.

**7.2 Pressure hold time** – allows lubricant pressure to dissipate in supply line after an elapsed amount of time.

**Notice**

**Pressure hold time** option is only available when **not** using an **end of line** pressure switch.

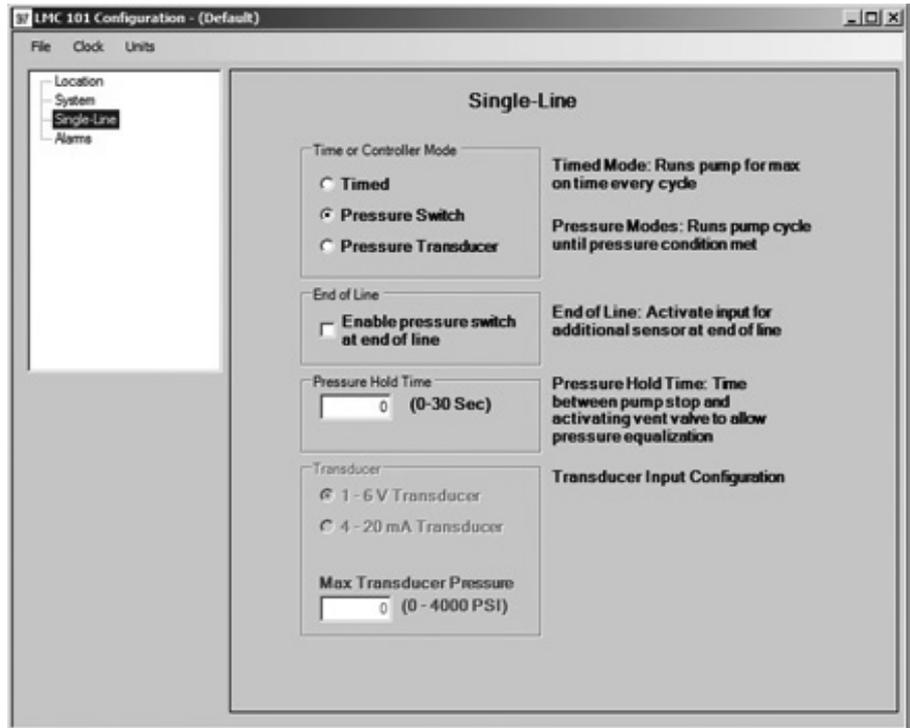


Fig. 7

8 Selecting **pressure transducer** radio button activates:

**! Notice**

If **pressure transducer** option is selected, a **pressures** option will display on left side menu.

**! Notice**

A pressure switch or transducer must still be used at pump in **End of Line** systems to prevent pressure build up.

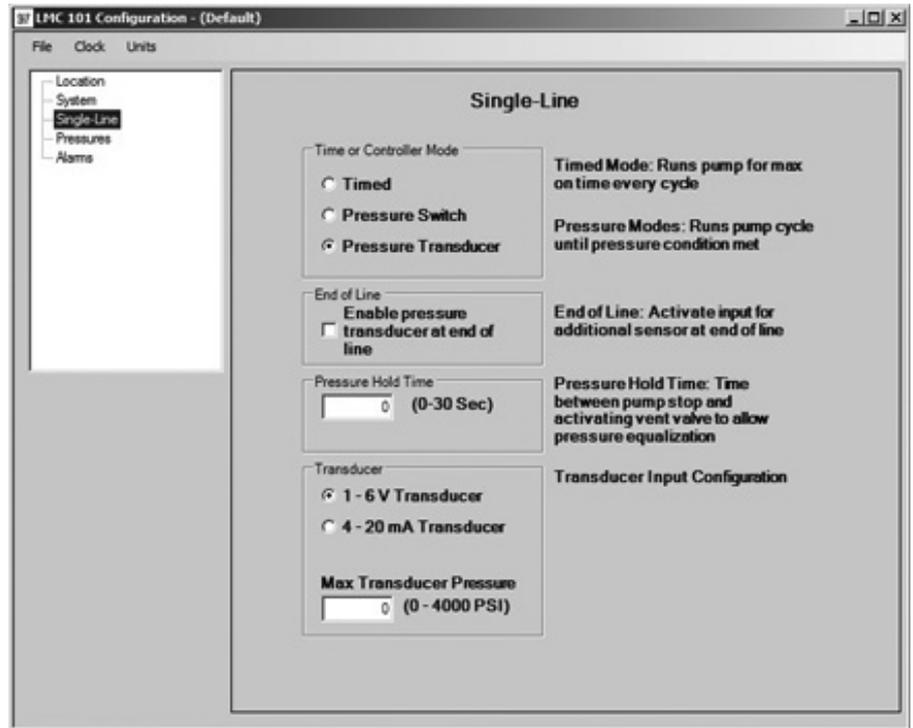


Fig. 8

**8.1 End of line** – allows use of a second pressure transducer at end of lube supply line to complete a lubrication cycle.

**! Notice**

**Pressure hold time** option only available when **not** using an **end of line** pressure transducer.

**8.2 Pressure Hold Time** – Allows lubricant pressure to dissipate in supply line after an elapsed amount of time.

**8.3 Transducer** radio button:

- **1 to 6 V Transducer** – allows use of a 1 to 6 V transducer.
- **4 To 20 mA transducer** – allows use of a 4 to 20 mA transducer.

**8.4 Max transducer pressure** – sets maximum pressure rating of transducer. Software allows for input range of:

- 0 To 4000 psi (Imperial units setting)
- 0 To 275 bar (Metric units setting)

9 Clicking on **pressure** displays:

**9.1 Pressure to insure injector vent**

– At start of lube cycle, pressure reading from transducer must be at or below this level. If using an **End of Line** pressure transducer, reading is taken from this transducer.



**Notice**

Option will only display in left side window if **Pressure Transducer** option selected.

**9.2 Pump pressure at which lube cycle ends**

– If only using one pressure transducer, lube cycle will end at this setting.



**Notice**

For **step 9.2**, if using an **End of Line** pressure transducer, pump will stop at this pressure level to allow dissipation of pressure in supply line. Pump will restart once this pressure level drops below 25% of this setting.

**9.3 Line pressure at which lube cycle ends**

– sets **End of Line** pressure transducer limit to end lubrication cycle.

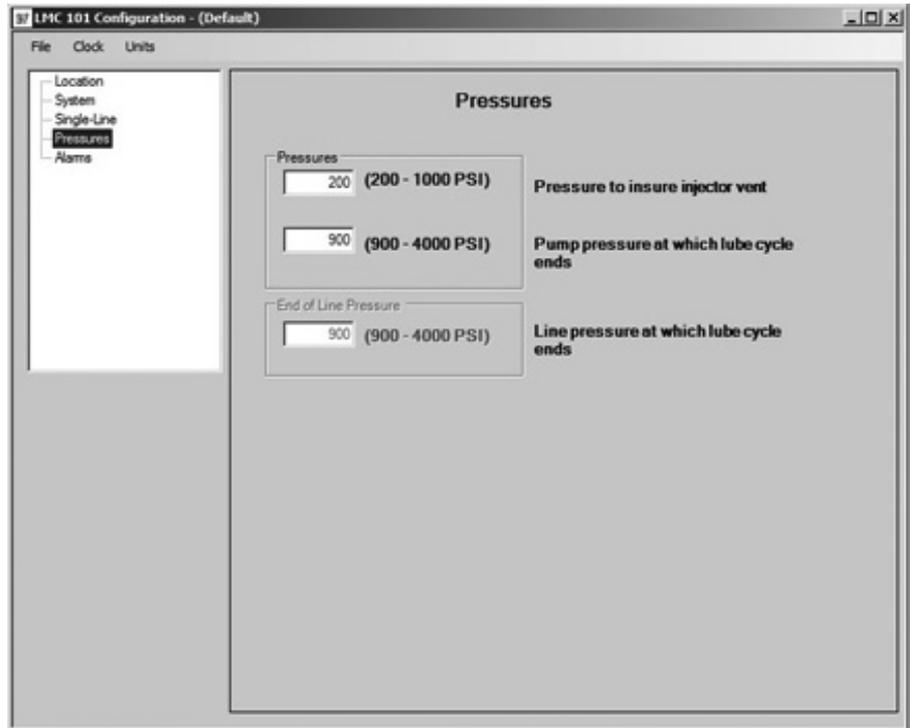


Fig. 9

10 Clicking on **alarms** displays:

10.1 **Low level fault** radio buttons –

indicates that reservoir is low or empty.

- **No more lube cycles after low level alarm** – no more lube cycles will occur after a low level alarm.
- **Continue to allow lube cycles after low level alarm** – lube cycles will continue after a low level alarm.
- **Limited number of lube cycles after low level alarm** – a set number of lube cycles will occur after a low level alarm.

10.2 **Pressure fault** – indicates that a pressure fault has occurred.

- **No more lube cycles after pressure alarm** – no more lube cycles will occur after a pressure alarm.
- **Continue to allow lube cycles after pressure alarm** – lube cycles will continue after a pressure alarm.
- **Limited number of lube cycles after a pressure alarm** – a set number of lube cycles will occur after a low level alarm.

10.3 **Alarm output setting for both alarm relays**

- **Relay contact closes on alarm** – alarm detection will close relay.
- **Relay contact opens on alarm** – alarm detection will leave relay open.

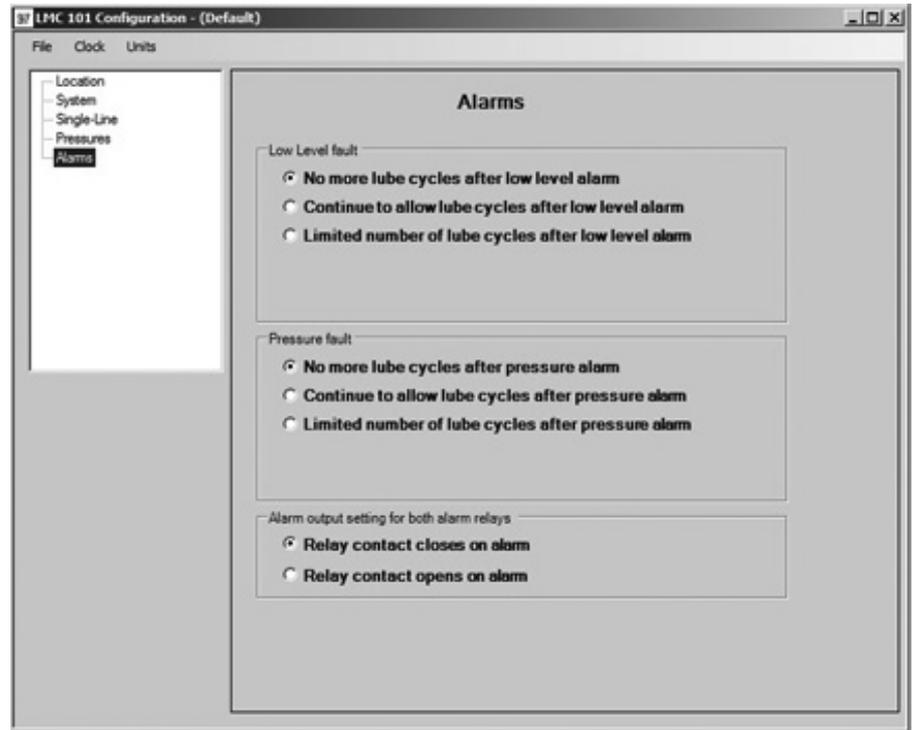


Fig. 10

## Progressive systems

1 Clicking on **system** displays:

- 1.1 **System type** - drop menu that defines system for controller as:
- Single-Line
  - Progressive.

### ! Notice

If system is **single line**, return to **step 1** on **page 8**.

- 1.2 **Pause time** – sets time spans between lube cycles.  
Range: 15 seconds to 99 hours.

### ! Notice

Within this time span, pressure switch, pressure transducer, or proximity switch must indicate end of cycle. Failure to indicate end of cycle within this time span will result in an alarm.

- 1.3 **Maximum pumping time** - amount of time that pump will be allowed to remain active.  
Range: 15 seconds to 99 minutes.

- 1.4 **Prelube** drop menu defines lubrication cycling when controller powers up. Available options are:
- **Always** – a prelube cycle will always occur after power up.
  - **After 3hr off** – a prelube cycle will only occur when power has been off for more than 3 hours.
  - **Never** – a prelube cycle will not occur after power up.

- 1.5 **Pulse active checkbox** - activates pump pulsing option during cycling, as defined by input time interval.

### ! Notice

Pulse air flow causes vent relay on control board to pulse on and off.

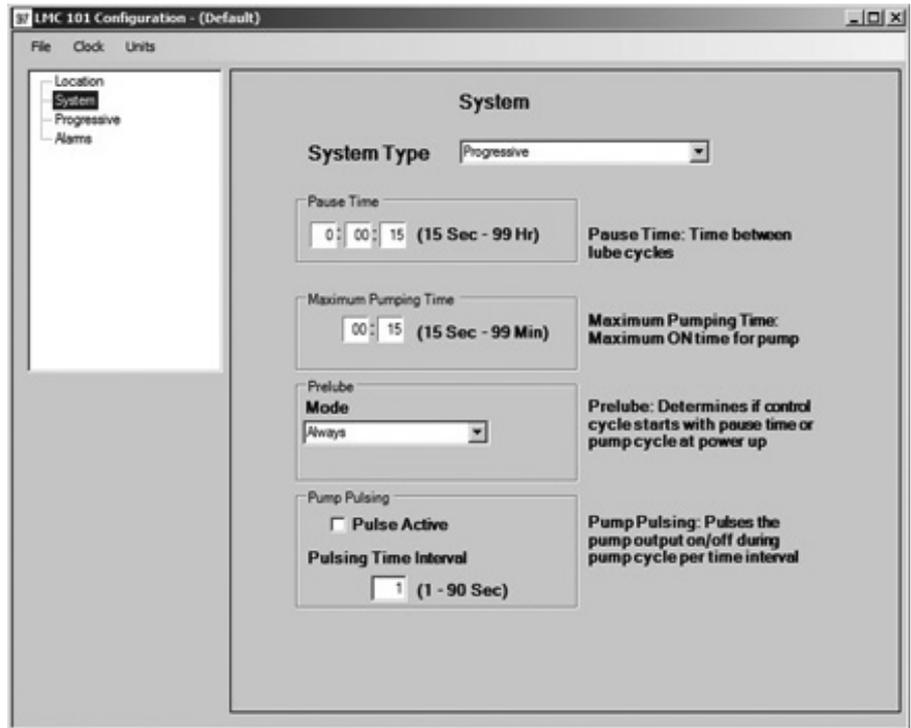


Fig. 11

- 1.6 **Pulsing time interval** - defines amount of time between pump pulses.

### ! Notice

Pulse time controls frequency of pulse air flow.

- 2 Clicking on **Progressive** will display **Timer** and **Controller** radio buttons:
  - 2.1 **Timed** – Amount of time that pump will be on.

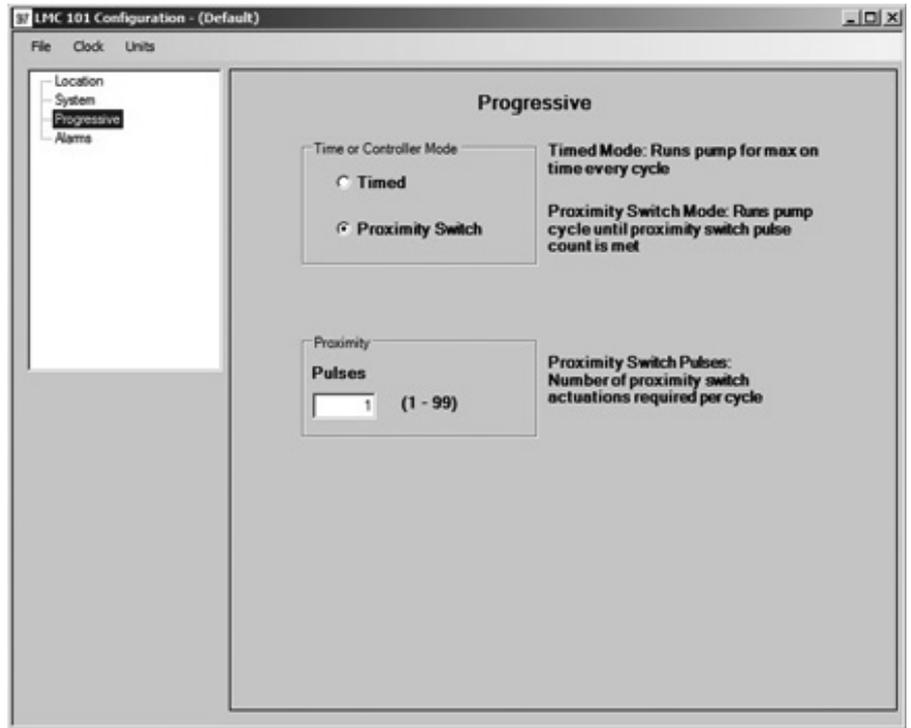


Fig. 12

- 2.2 **Proximity switch** – proximity switch actuation ends lube cycle.
- 2.3 **Proximity** - Number of proximity switch actuations per cycle.

**! Notice** Proximity switch must actuate number of times entered in **Pulses** box during each lube cycle. Failure of controller to detect number of actuations within defined maximum pumping time triggers alarm.

**! Notice** For instructions on **Alarm** features, refer to **step 10** on **page 13**.

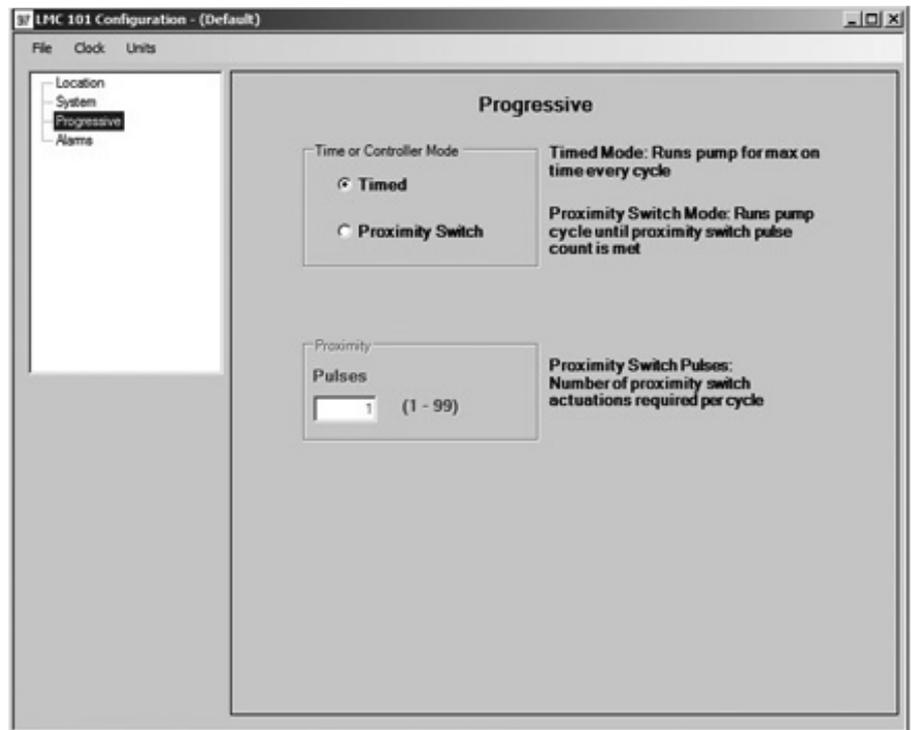


Fig. 13

# Controller history

- 1 From main screen, click **history** button. The **controller history** window will display (fig. 15).
- 2 Each button on right side of window will produce a different type of history report. For all reports:
  - each event will be time and date stamped.
  - all data can be transferred by using copy (**Ctrl+C**) and paste (**Ctrl+V**).
  - a maximum of 72 event will be captured.

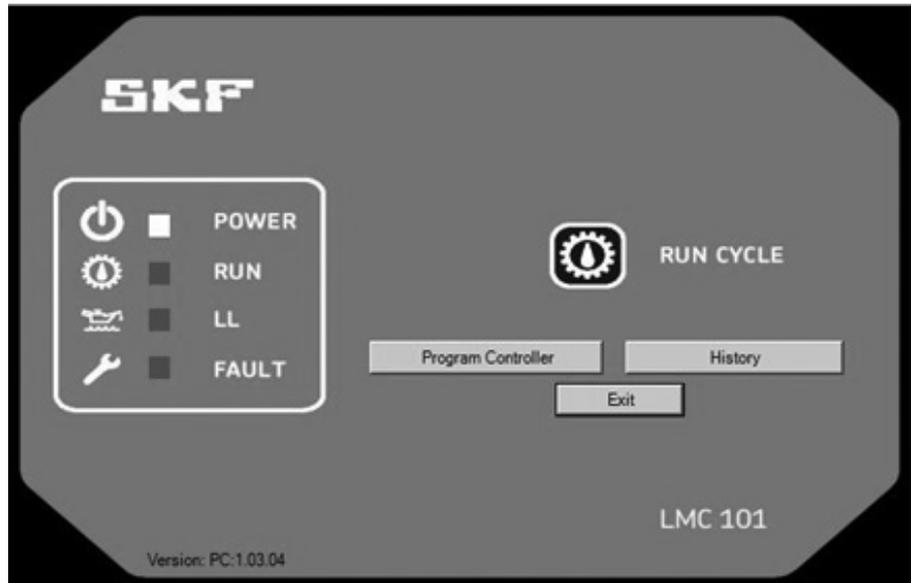


Fig. 14

## Notice

If more than 72 events are present, only the most recent 72 reports will be captured. Older events will not be included.

- 2.1 **System** button – captures date and time for any system reset, including each time:
  - a controller powers up.
  - a new configuration is saved to a controller.
- 2.2 **Lube cycles** button – captures date and time for each successful lube cycle.
- 2.3 **Alarms** button – captures date and time for each alarm that prevented cycling.
- 2.4 **Counters** button - captures counts for:
  - All attempted lube cycles
  - All successful manual lube cycles
  - All alarm events caused by pressure
  - Low level alarms
  - Total amount of time that pump has been on.
- 2.5 **Clear counters** button - resets all alarm counts to zero.

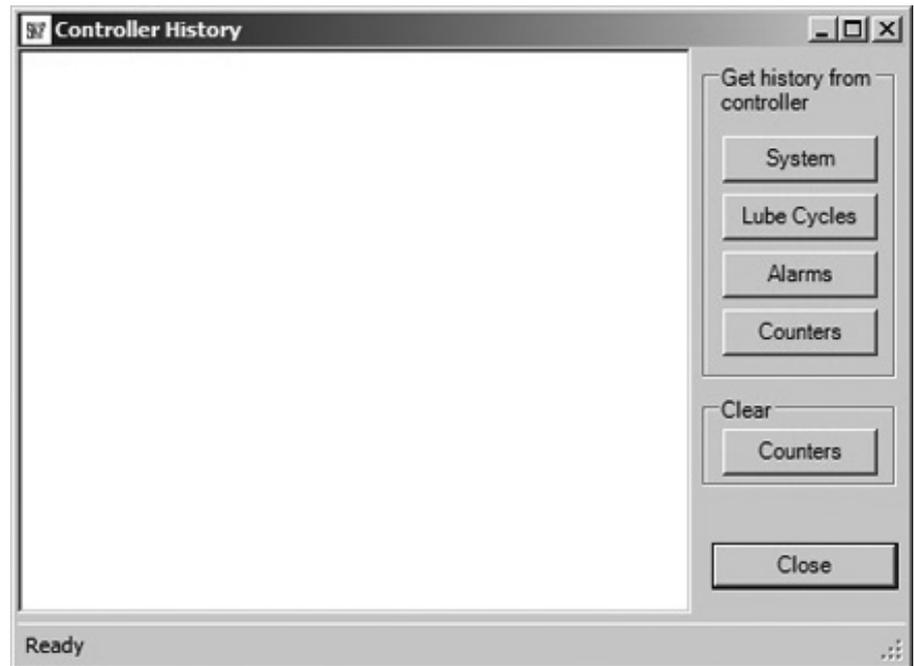


Fig. 15

# Firmware update



## Notice

Only perform these steps when notified of firmware updates.

- 1 Remove power from LMC 101.
- 2 Remove controller cover.
- 3 Attach LMC 101 to PC via USB cable.  
Controller's Run light will blink for 13 seconds.
- 4 Launch Firmware Updater Utility on PC.  
**Fig. 16** will display.



## Notice

Firmware update utility must connect to controller within 13 seconds.

- **If light continues to blink**, connection was successful. Continue to next step.
- **If light stops blinking**, connection was unsuccessful. Repeat **steps 1-4** until light continues blinking.

- 5 Click **Find** button.
- 6 Navigate to latest code file (.Hex file).
- 7 Highlight code file and click **open**.
- 8 Click **Update Firmware** button.
- 9 Wait until firmware update utility finishes.
- 10 Unplug USB cable from controller and reattach controller cover.
- 11 Reconnect power to controller and return to service.



Fig. 16

# Controller installation and field wiring

Connect field wiring to the LMC 101 by following the wiring diagram (→ **figs. 19-22, pgs. 20-23**) appropriate to your single-line and progressive systems. Refer to the diagrams for specific information on power connections, inputs, outputs, and connection polarity.

**1** Route the **86535** connection cables through the cable glands (**4** and **5**) on the bottom of the enclosure (**8**).

- 2** Refer to wiring diagram and make electrical connections.
- 3** Program the controller.
- 4** Place the front cover (**4**) onto the enclosure (**7**).
- 5** Mount the controller using dimensions in **fig. 18**.

**! Notice**  
Relieve tensile force on cables from outside of housing.

**! Notice**  
Terminals for signal inputs (**1**), for supply (**2**), and actuator lines (**3**) are located on control PCB (**fig. 17**).  
Refer to wiring diagrams for detailed information on wiring connections (→ **figs. 19-22, pgs. 20-23**).

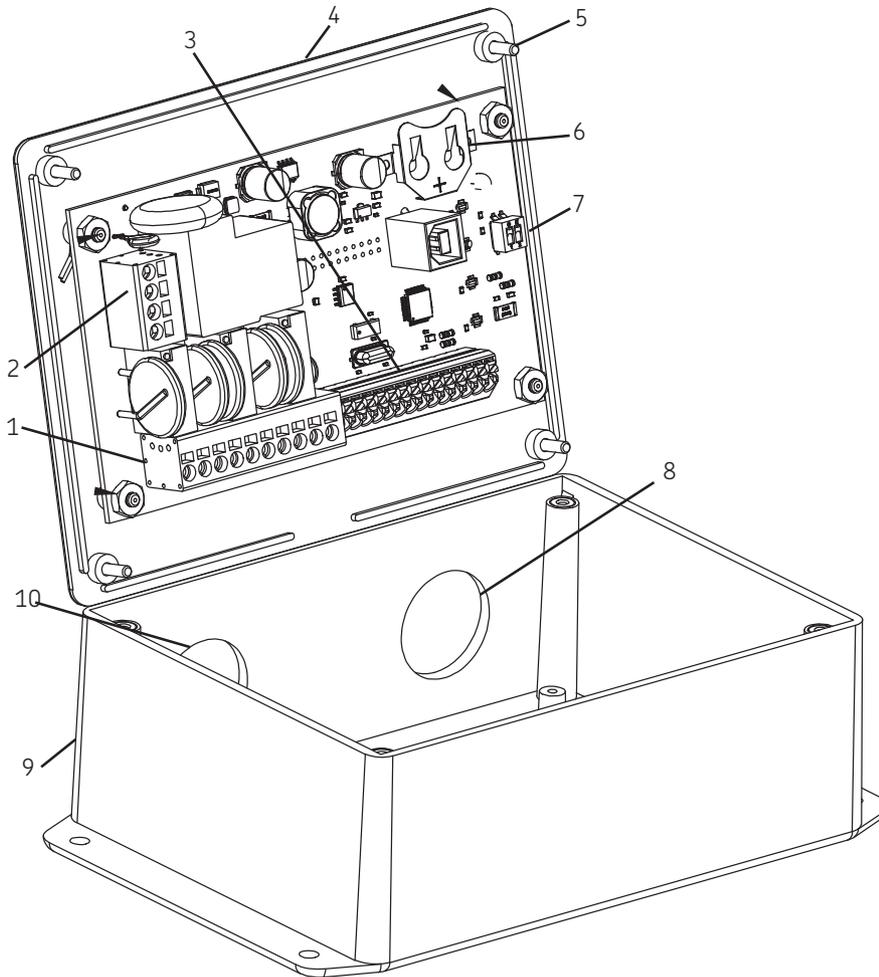
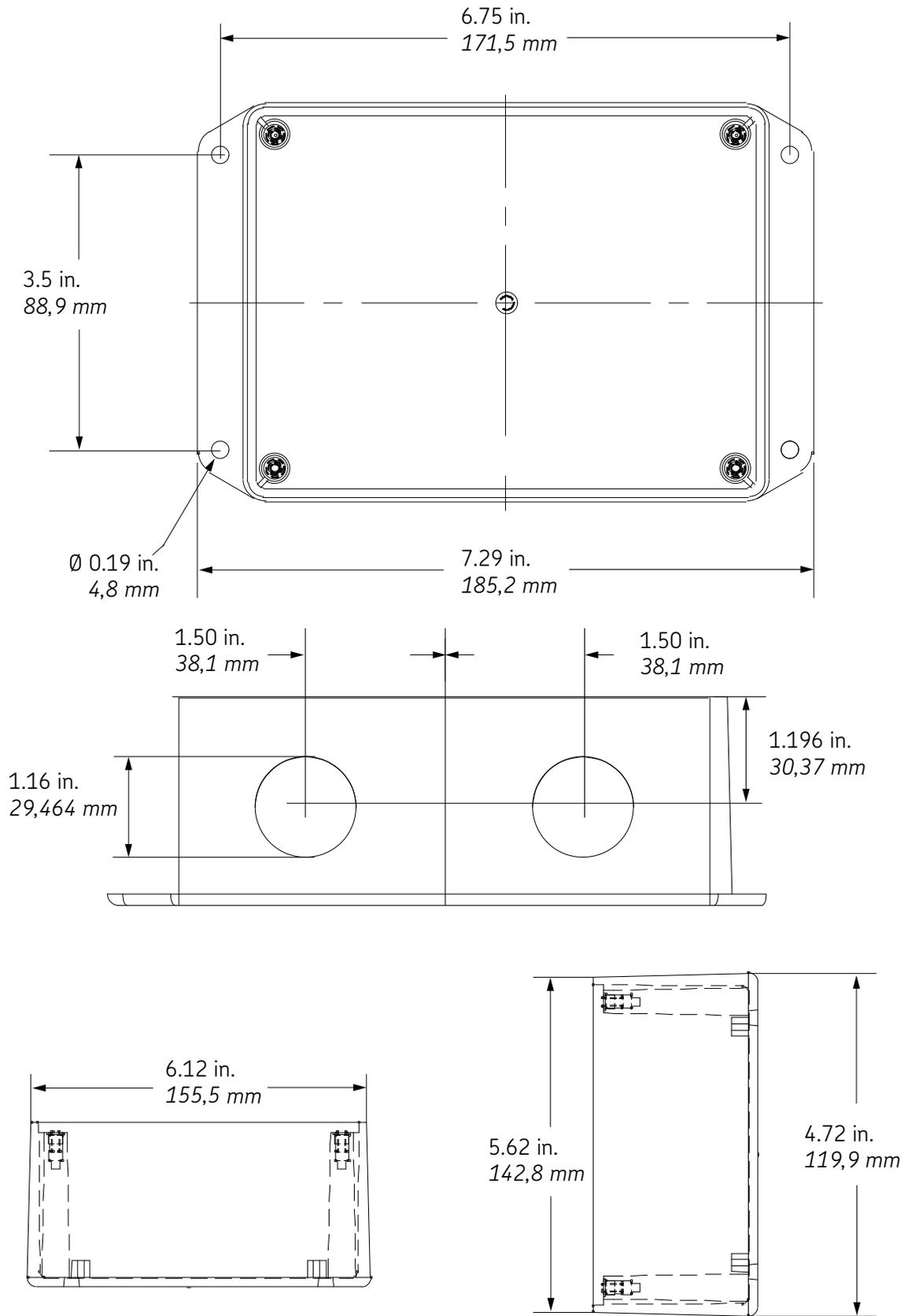


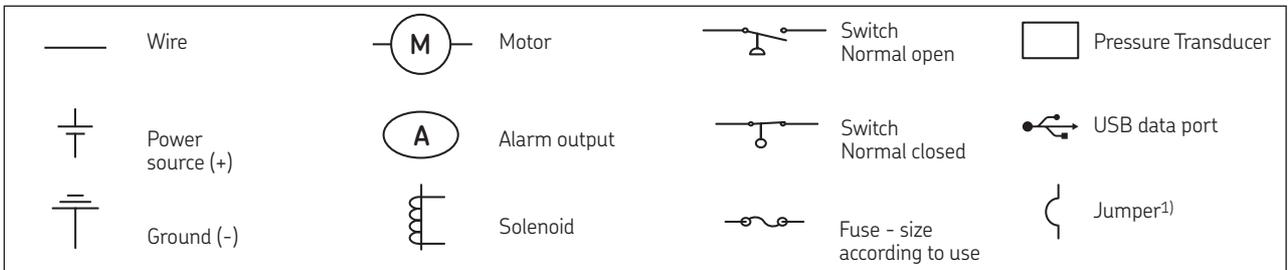
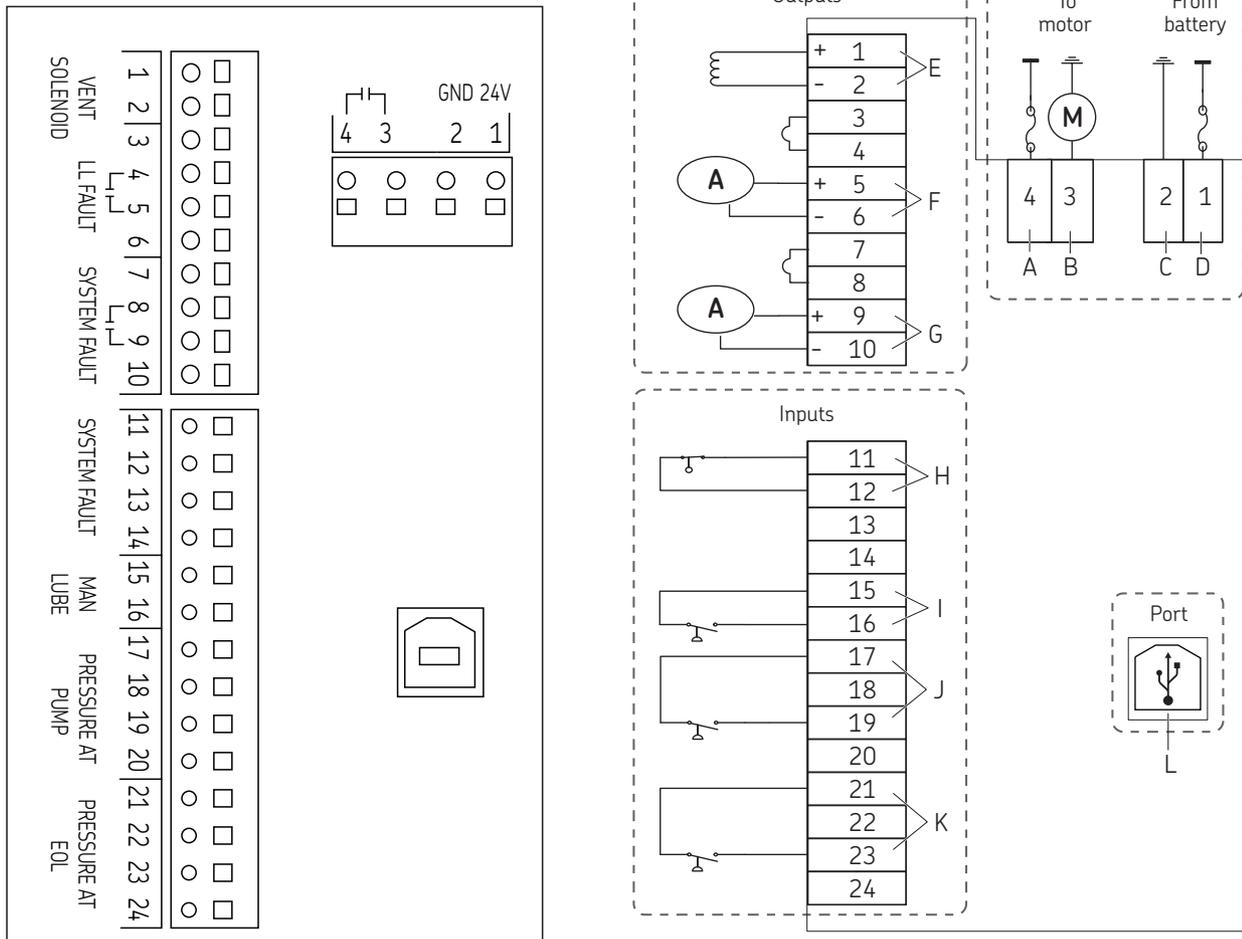
Fig. 17

Callout	Description	Callout	Description
1	Control output (actuator) 4 relay outputs 1 electronic output	5	Screw
2	Input power and pump power	6	Button cell lithium battery, 2032
3	3 wire initiators up to 24 volts (PNP) 2 wire initiators, residual voltage < 5 volts	7	USB type B
4	Front cover	8	Cable gland for control inputs and outputs 1/2 in. (12,7 mm) diameter
		9	Enclosure
		10	Cable gland for voltage supply 1/2 in. (12,7 mm) diameter

Dimensions



Field connections - wiring diagram for single-line system using pressure switches



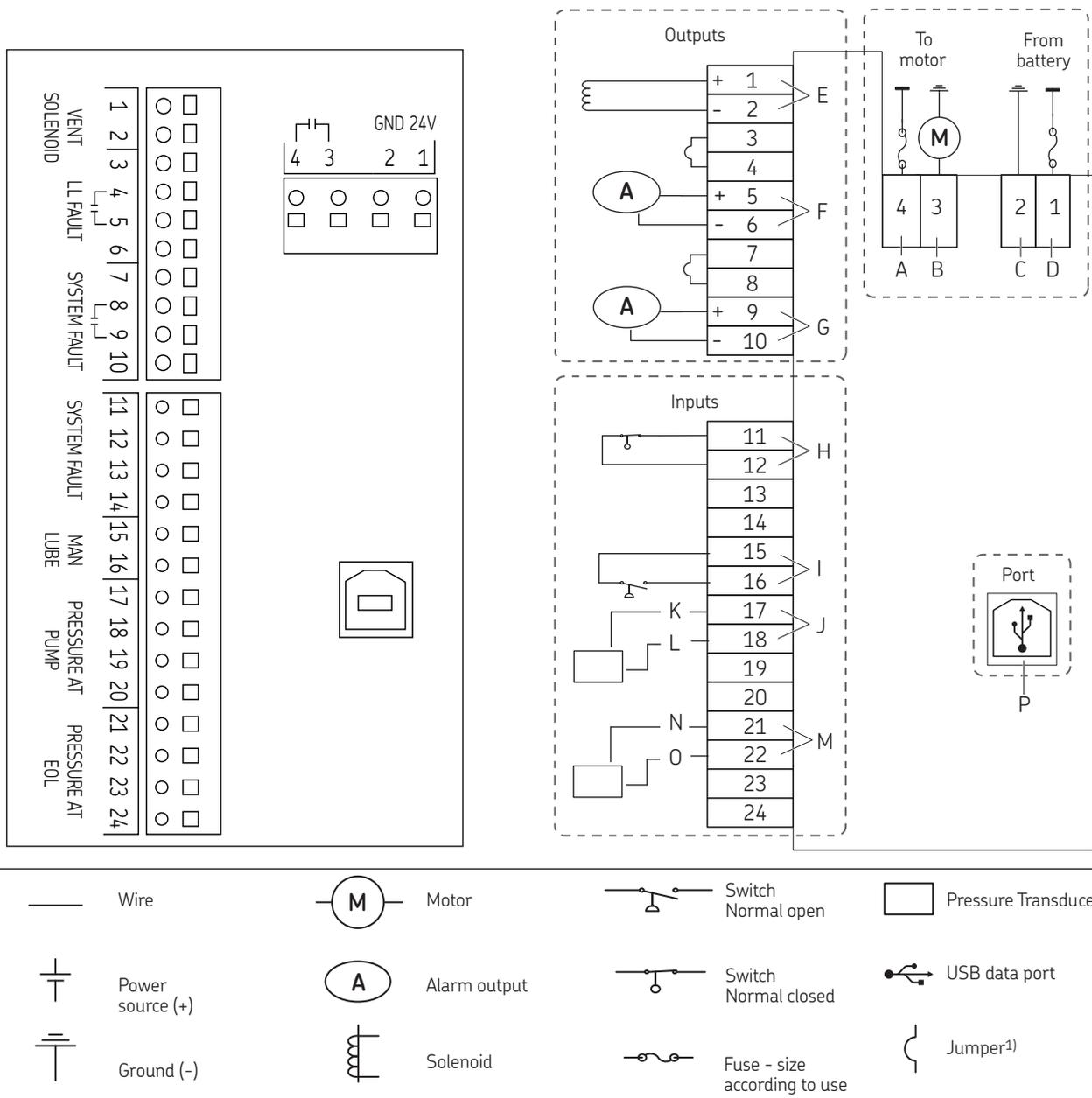
1) Jumper connects (+) battery power to positive terminal of alarm contact. Disconnect jumper for open contacts.

Table 3

Key code for fig. 19 - single-line system using pressure switches

Callout	Description	Callout	Description
A	Positive (+) to motor (from battery)	G	System alarm
B	Ground (-) to motor	H	Reservoir low level
C	Ground (-) from battery	I	Remote manual lube
D	Positive (+) from battery	J	Pressure switch at pump
E	Vent solenoid	K	Pressure switch at EOL (end of line)
F	Low level alarm	L	USB port

Field connections - wiring diagram for single-line system using 4-20 mA pressure transducers



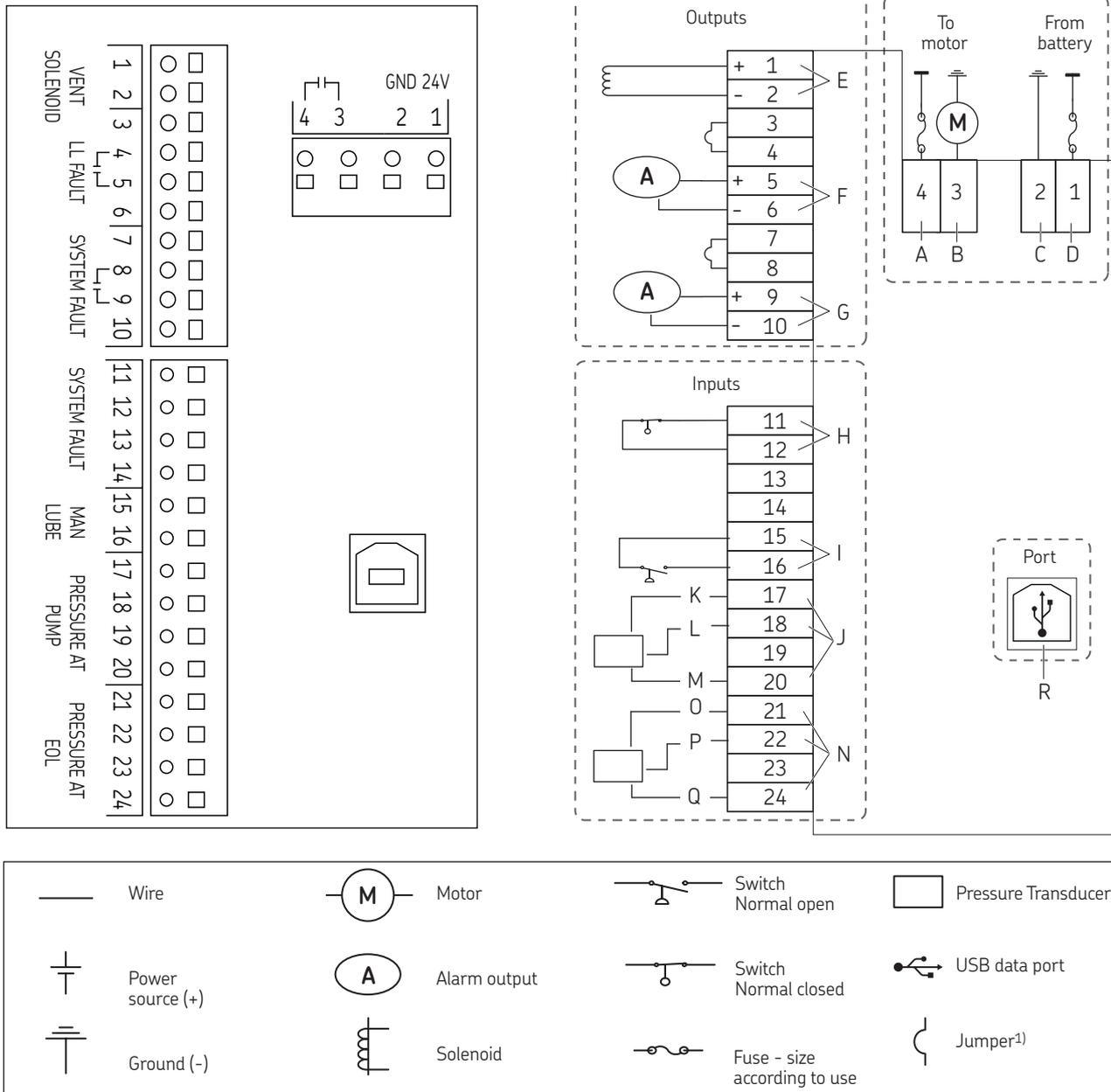
<sup>1)</sup> Jumper connects (+) battery power to positive terminal of alarm contact. Disconnect jumper for open contacts.

Table 4

Key code for fig. 20 - single-line system using 4-20 mA pressure transducer

Callout	Description	Callout	Description
A	Positive (+) to motor (from battery)	J	4-20 ma pressure transducer at pump
B	Ground (-) to motor	K	(+) signal
C	Ground (-) from battery	L	(-) signal
D	Positive (+) from battery	M	4-20 ma pressure transducer at EOL
E	Vent solenoid	N	(+) signal
F	Low level alarm	O	(-) signal
G	System alarm	P	USB port
H	Reservoir low level		
I	Remote manual lube		

Field connections - wiring diagram for single-line system using 1-6 V pressure transducers



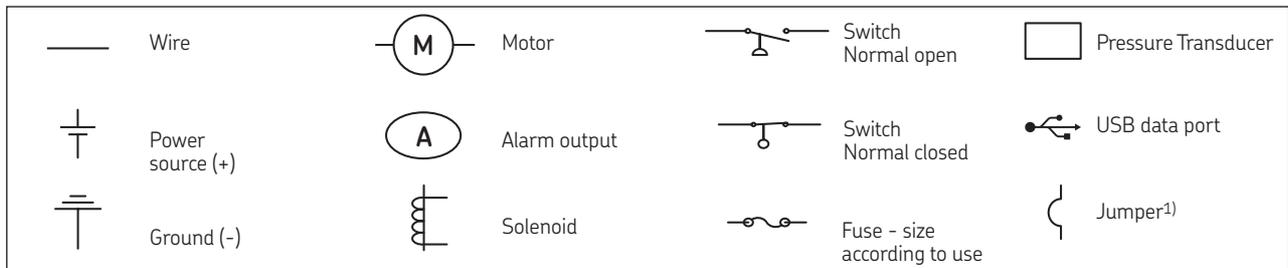
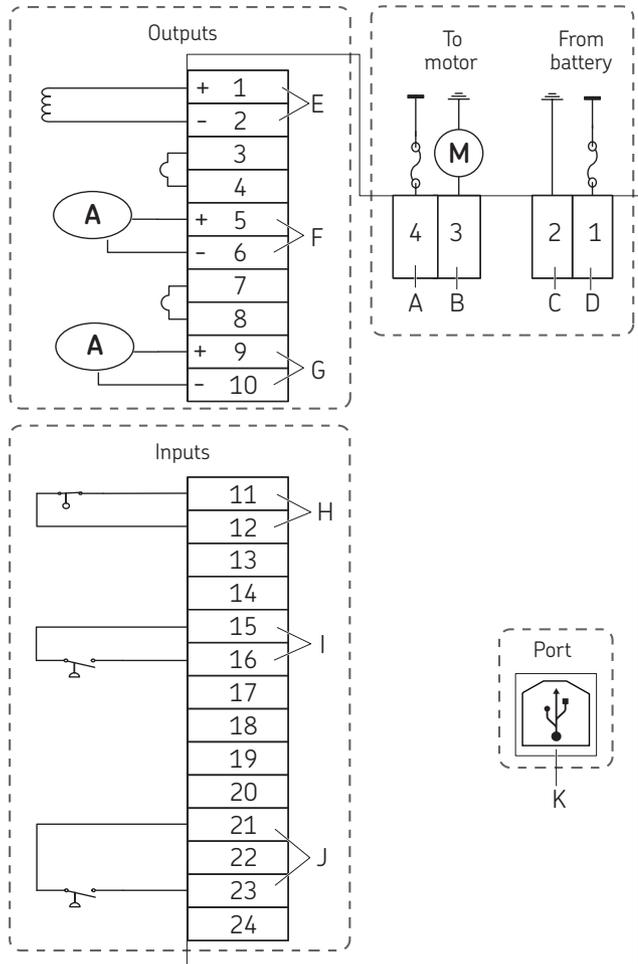
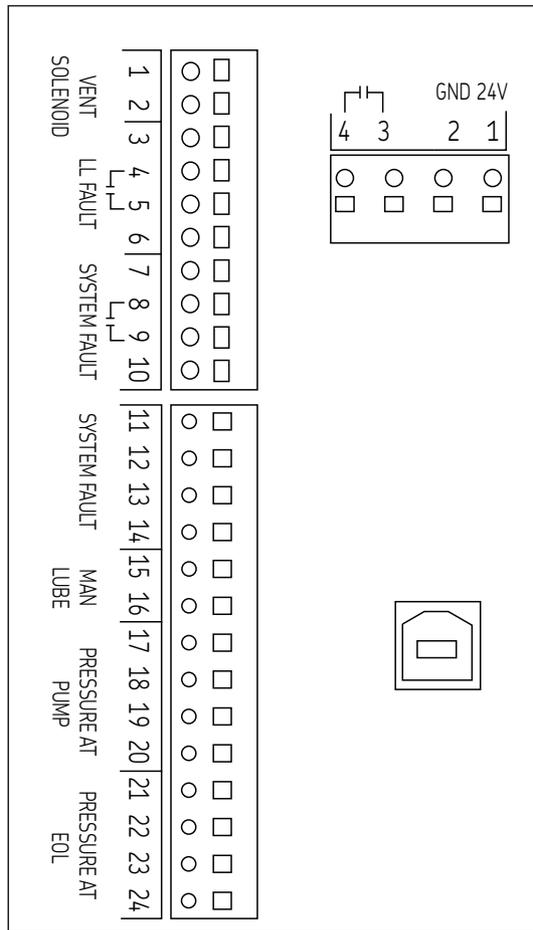
<sup>1)</sup> Jumper connects (+) battery power to positive terminal of alarm contact. Disconnect jumper for open contacts.

Table 5

Key code for fig. 21 - single-line system using 1-6 V pressure transducers

Callout	Description	Callout	Description
A	Positive (+) to motor (from battery)	J	1-6 V pressure transducer at pump
B	Ground (-) to motor	K	(+) Power
C	Ground (-) from battery	L	(+) Output
D	Positive (+) from battery	M	Common
E	Vent solenoid	N	1-6 V pressure transducer at EOL
F	Low level alarm	O	(+) Power
G	System alarm	P	(+) Output
H	Reservoir low level	Q	Common
I	Remote manual lube	R	USB port

Field connections - wiring diagram for progressive system using piston detector



<sup>1)</sup> Jumper connects (+) battery power to positive terminal of alarm contact. Disconnect jumper for open contacts.

Table 6

Key code for fig. 21 - progressive system using piston detector

Callout	Description	Callout	Description
A	Positive (+) to motor (from battery)	G	System alarm
B	Ground (-) to motor	H	Reservoir low level
C	Ground (-) from battery	I	Remote manual lube
D	Positive (+) from battery	J	Piston detector
E	Vent solenoid	K	USB port
F	Low level alarm		

## The Power of Knowledge Engineering

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