Elationtech
Your Construction Technology Partner

EG2
Machine Control System

Instruction Manual

Ver. 7 June 2022

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System Description

The EconoGrade Machine Control Systems were designed to let you achieve maximum control of your grading system, at an economical price. The EG Series can be installed on a number of machines including box blades, box scrapers, graders, mini-graders and skid steers. The system controls most valve packages, giving the user both LED and a real-time LCD display so you are always in touch with the blade position. The EG Series Receiver can detect any rotating red beam laser within its 173mm (7") capture range, and in turn indicates the blade's position to within a 2mm (5/64") accuracy. The receiver has LED indicator lights that give the same output as the control box LED indicators. So whether you're standing on the field, or driving the machine you'll always know where your blade needs to be. The control box allows the user to configure the display to indicated variances from the on grade position in real time. The receiver attaches to a 45mm (1 3/4") standard pipe. The complete system requires 10 - 30vdc to operate. The valve drives are rated for 5 Amps.

System Components

Control System

Control Box P# CB-EG2 (F)

Slope Sensor P# BS-10(F)

Receiver
P# RC-EG1(F)

Cable Set

Com. Node Cable
P# 102765

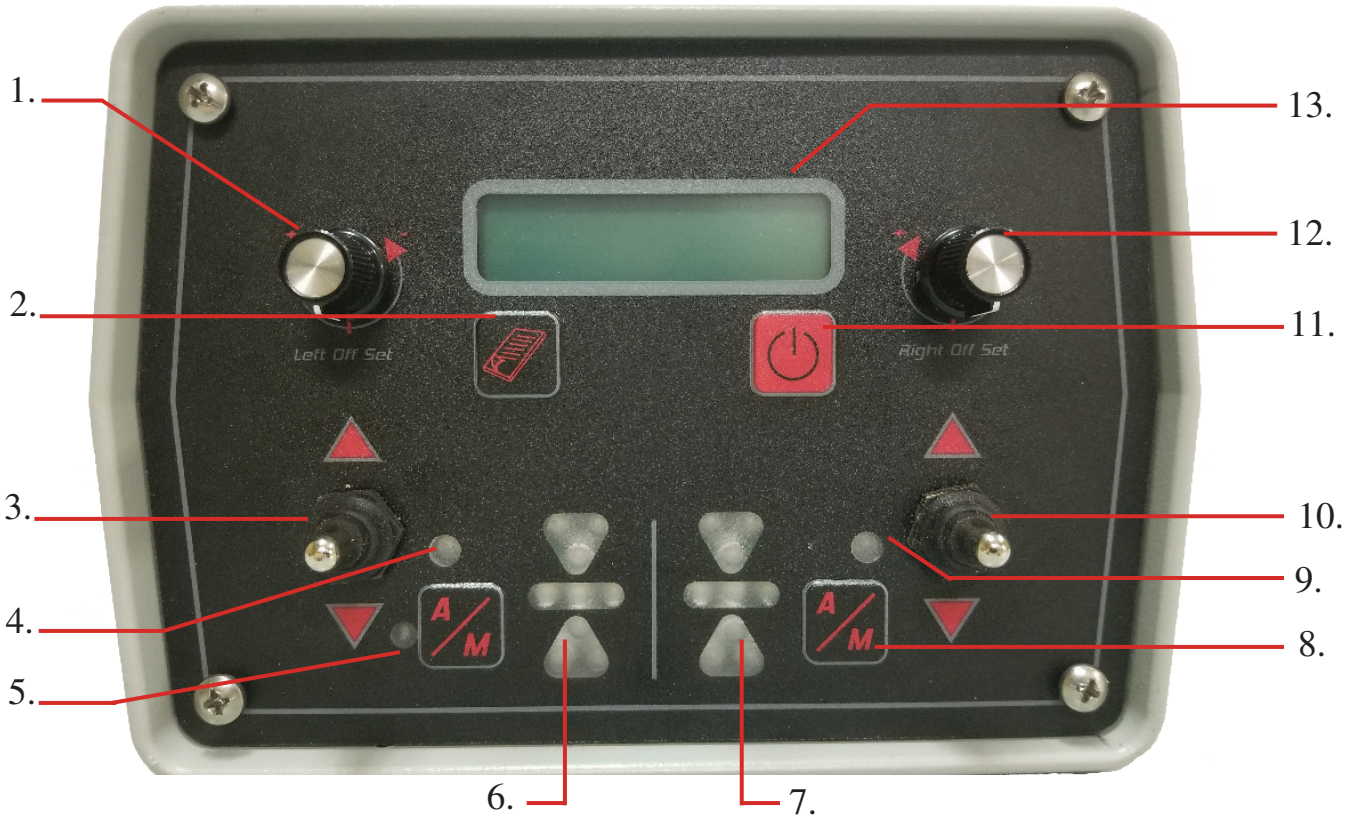
Power Cable
P# 102198

Valve cable
P# 102196

Receiver cable
P# 102440

Optional Telescoping Mechanical Mast
P# EG-Mast(F)

EG Series Control Box
Controls
(fig 1)



1) Left On-grade Offset -
12) Right On-grade Offset - These knobs control the offset of the on-grade of each receiver. They allow the operator to move the on-grade position on either side up or down by 54mm (2.13 inches). The left knob can also be used to cycle through the menu screens, backwards or forwards. The right knob can be used to change values on each menu screen.

2) Menu Button - This key is an alternative method to step through the menus to setup all of the controls in the system. Pressing either of the A/M keys is a shortcut back to the main screen, a quick way to start over.

3) Left Valve Raise/Lower Switch -
10) Right Valve Raise/Lower Switch - These switches are used for manual control and allow the operator to raise and lower each hydraulic circuit on the machine. These switches also act as a control in the menu and are used to change parameters in the menu display.

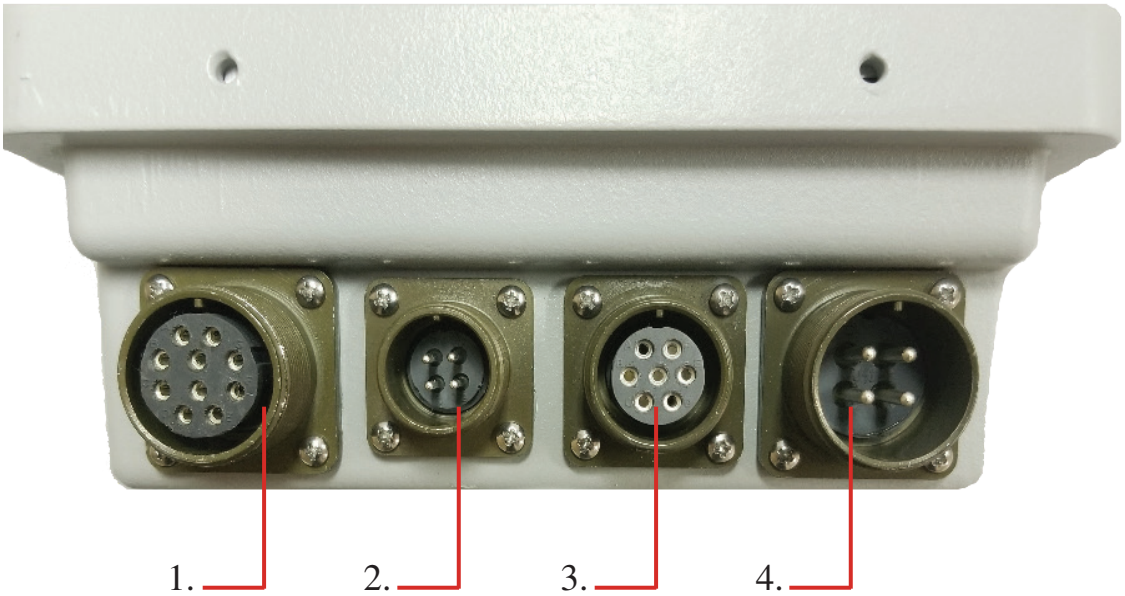
4) Auto/Manual Indicator -
9) Auto/Manual Indicator - These indicators display when the system is in the automatic mode, if the light is on, the system's control is active.

5) Left Auto/Manual button -
8) Right Auto/Manual button - These buttons switch the EG Series system between automatic and manual control modes. The right switch controls both the left and right sides together and the left switch controls just the left. This configuration allows a method of controlling both sides together as well as individually.

6) Left LED Grade Display -
7) Right LED Grade Display - These LED's display whether you are above grade, below grade or on grade. The red arrows tell the user which direction the blade must move to achieve grade, while the single up or down red LED will flash when the receiver is within 10mm (0.39") of the desired grade. The green LED's in the middle will flash when you are within your desired 'on grade'.

11) Power On/Off switch - Press the power button briefly to turn the control box on. The button must be pushed and held for approximately two seconds to turn the system off. This button is also used as a soft key providing the function indicated in the display directly above it.

13) LCD Display - A 2 x 16 dot matrix display for easy visibility in bright and dark environments.



1. Valve Cable Connector - This is where the valve cable is connected to the control box.

2. Remote Switch Connector - The remote auto/raise/lower switch assembly plugs into the control box via this connector.

3. Communication Connector - Receiver and Sensors plug into the node cable, and their signals are transferred to the control box via this connector.

4. Power Cable Connector - Battery power is routed to the system via this cable connection.

EG Series Control Box

Display Screens and Menus

Splash Screen - Displays system type and version. The version and version date may change as features and program modifications are implemented.

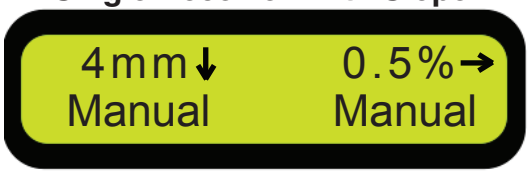
Main Operating Screens

The Main Control Screen: This is the first screen displayed after the 10 second start up routine is complete. The control screen will look different depending on how the system setup is configured. The three main configurations are shown here.

Single Receiver

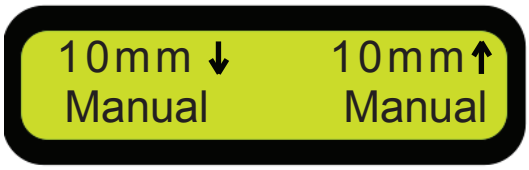
Single Receiver Control - The upper left reading is the real time position of the laser beam on the receiver in metric or imperial depending on the units configuration. The upper right is the receiver on-grade offset entered in via the right offset adjust knob.

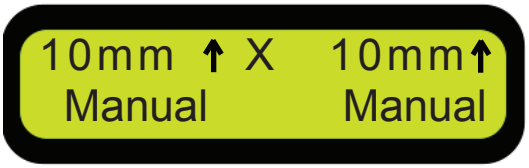
Single Receiver with Slope



Single Receiver with Slope Control - The upper left shows the receiver on-grade offset, which can be entered by the left offset adjust knob. The upper right displays the desired slope, this value is entered by the right offset knob.

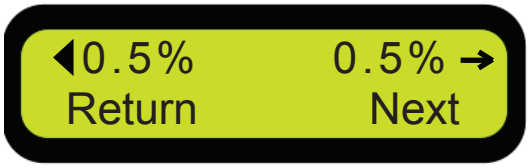
Dual Receiver





Dual Receiver Control - The upper left and right display are the receiver on-grade offset values. They are adjusted via the adjustment knobs. The left knob adjusts the left offset and right knob adjusts the right offset. We can also temporarily link the left and right offset together. This is accomplished by pressing the power button once. An X will be displayed between the two offset values. While the X is present, the right offset knob will adjust both the left and right offset values together. The X will disappear 5 seconds after the value has been entered.

Slope Indicate / Control



Slope Indicate / Control -
If the system has the slope option and the slope option is enabled, pressing the menu button once will display the slope indicate / control screen. Here the real-time slope is in the upper left side of the display and the direction is shown by a thick direction arrow. The desired slope is in the upper right hand side of the display and the direction is shown by a thin direction arrow. The desired slope is entered via the right off set knob while this screen is active. The system will remain in this slope screen until either the return or next key is pressed. The return key returns you to the main control screen and the next key will continue to the menu screens.

```
Pass |EFFF| 0000
->          Return
```

System Lockout Screen - If there is a lockout code enabled, this screen will appear. You must enter the system password to be able to go any further into the menu screens. If this option is not needed it may be disabled in the installation menu. Password is factory set to 1000

```
FAST -I- - - -  Slow
Filtering       Next
```

Filtering - Changing the filtering rate can help to cure any jumpy behaviour of the receiver. The best setting is the fastest setting with the least amount of interruptions.

```
Lsr Rec. deadbnd
20mm   grade   Next
```

Laser Receiver Deadband - Is the amount of allowable on-grade tolerance. The range is 1mm to 30mm at 1mm steps. When the receiver is receiving the laser light in the on-grade position, the valves will not activate until the deadband range is passed. If the on-grade deadband is set to 10mm, the valves will not be activated until the receiver readings are beyond 5mm in either direction.

```
Horn            Off
                Next
```

Horn - Sets the function of the internal beeper. **Off:** disables the internal beeper. **Alert:** sets the beeper to grade alarm mode. When in automatic, if there is no on-grade indication for 6 seconds the alarm will sound. **Indicate:** sets the beeper to indicate mode, where the beeper will act as a detector. If the beam is too high you get a double beep, too low a single beep and on grade a solid beep.

```
Height Adj      ON
                Next
```

Height Adjustment - By setting the height adjustment option to **"ON"**, the off-set knob is enabled and the user has the ability to have an adjustable 'on grade' which is displayed on the LCD. If the Height adjustment is off or **Height set to "0"**, the off-set knob is disabled and the 'Real Time' blade position is displayed on the LCD.

```
Use millimeters
Change          Next
```

Unit selection - Sets for 3 different units: **Millimeters**, **Inches** (decimal inches) or **Feet** (10th of a foot).

```
LATEC Instr.    Inc
5192354585      Next
```

Latec Info Screen - The final screen in the menu displays manufacturer info: name and phone number. Outside of North America, dial +01.519.235.4585.

To access the Installation Menu , press the Menu and Power button in UNISON while the LATEC info screen is displayed.

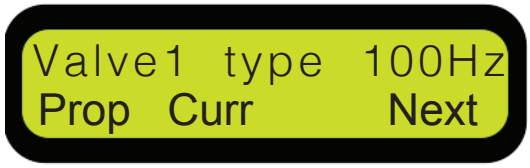
```
Remote:   Dual
Change          Next
```

Remote Type Screen - This menu allows for the selection of the EG2 remote type (optional). Dual is the standard setting, and Single allows for an EG1 switch to be used. Momentary is for custom applications where an instantaneous signal can toggle the Auto/Manual setting. Elev +/- is for custom applications where the on-grade offset can be adjusted remotely.

Valve Settings

Valve1 Types (Left Side) - EG Series can control proportional time ('bang-bang') valves, proportional valves with integrated electronics (Danfoss), Selective Control Valve (SCV) and proportional current (variable flow) valves. There are three Proportional current settings: 50 Hz., 100 Hz., and 200 Hz.; Consult the valve manufacturer to find the proper type and dither frequency for your valve.

In **Proportional Time** mode, the EG Series valve output is an on/off voltage, high current output; the output voltage will, during the valve on time, be equal to the DC input supply.



In **Proportional Curren**t mode, the EG Series valve output is a pulse-width-modulated, high current output; the output voltage will, during the valve on time, be equal to the DC input supply.

The **Danfoss** setting, as well as producing the low power analogue control signal for the valve, also drives both of the high current valve outputs. One of those high current outputs can supply power to the Danfoss valve, and the other can operate the hydraulic system loading valve as recommended by the manufacturer.

Valve Control Direction can be changed to alleviate the need to change wiring or hydraulic plumbing. To enter Valve Direction menu, press the **Menu and Power Button in Unison**, then press the Menu button to switch between Normal and Inverted

Proportional Time Valve Settings:

CAUTION: THE FOLLOWING ITEMS WILL OPERATE THE HYDRAULIC VALVE. BE CAREFUL WITH THEIR USE! MAKE SURE YOUR AREA IS CLEAR.

If your valve has been set to either proportional current or Danfoss, go to Minimum DC setting on next page. Proportional time continues below.

Minimum Pulse Width - The EG Series needs information about the hydraulic system on your machine, as all hydraulic systems are not the same. Here we are telling the system the signal needed to move the cylinder at its slowest speed. Pressing the Menu (Test) button will enter you in to this routine. Your hydraulics will begin to move. Use the right raise/lower switch to increase or decrease the signal to the valve until you get a blade movement of approximately 0.5 inches per second. Press the menu button to change the direction, then adjust the cylinder speed for the opposite direction. When the cylinder speed is OK then press the power button (Stop) and these values will be stored. There may be a need to enter different values for Up and Down to balance the over all minimum speed. This is due to gravity helping in the downward direction and the volume differences in the cylinder, from the cap end to rod end.

Note: that either the "Stop" button, or the Power button will turn off the valve drive, and return you to the Minimum PW window. Also, the valve will shut off automatically after 20 seconds without any buttons being pushed.

Valve Cycle Time - This screen will only be displayed as part of the Proportional Time valve setup. This menu function sets how often the valve pulses are sent to the hydraulic valve, called hits per second. The range is 1 - 15 hits per second and unit is in milliseconds, to calculate the hits per second divide 1000 by the milliseconds. eg.1000 / 250 ms = 4 hits per-second. The lower the number the more hits per-second. For most hydraulic systems, starting at 150 ms is a good place to start. The faster you can hit the valve the smoother it will seem to respond, the valve response will differ from valve to valve. Playing with this setting will show you your valve's limitations.

Proportional Current and Danfoss Valve Settings:

Proportional Time users proceed to the Valve Gain screen.

Minimum DC Pulse Width - This screen changes slightly when the Proportional Current and Danfoss valves are selected. It's functions and procedures are exactly the same as the Proportional Time routine except the units are in percent.

Note that either the "Stop" button, or the Power button will turn off the valve drive, and return you to the Minimum PW window. Also, the valve will shut off automatically after 20 seconds without any buttons being pushed.

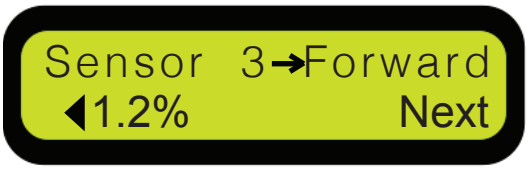
All Valves Types:

Valve Gain - The span of error between the onset of valve operation and the point at which the valve is fully on is determined by the valve gain setting. In this case, the units displayed (percentage) are arbitrary. The higher the number the more aggressive the hydraulic system. With the gain set to 100%, the slightest error will fully open the appropriate valve. This setting should be left at 50% until after the Minimum Pulse width has been set and the hydraulics tested to see in which direction you would like to adjust this setting. Conversely the lower the number the less aggressive the hydraulic system will be.

Derivative Gain - To stabilize some machine control applications, it is necessary for the control box to know not only whether the machine is at the desired slope or not, but how fast the slope is changing and in what direction. This is known variously as velocity or derivative (dv/dt) feedback. The control box can vary the amount of velocity feedback added; choose among: “High” “Medium” “Low” or “Off” This setting is to be left at medium for almost all installations.

Auto Return - Is the time duration that it takes for the valve to return the blade to the on-grade range after being manually driven away from the laser light using the raise/lower switch. The options available are in increments of 0.5 seconds with a range from 0 (off) to 7.5 seconds. After the set time is expired, the unit will move toward the last laser hit that it received. To disable this feature set the time to 0.

Tilt Sensing On/Off - This is where you turn slope sensing on If your system has the optional slope sensor feature. If Tilt Sensing is set to Off the next menu will be Factory Settings.



Sensor Forward - For flexibility in the sensor mount process, the forward axis selection can orient the sensor after it is already mounted. The label on top of the sensor shows a number for each quadrant, enter the number that is facing the forward direction of travel. This will orient the sensor axis. In the bottom left corner, the real-time slope is displayed, this will help in mechanically adjusting the sensor to zero (level) after making sure the control surface is level before calibrating.

Sensor Calibration - To ensure the sensor will produce relevant readings, it must first be calibrated. Ensure the sensor is enabled in the Tilt Sensing On menu. Mount the sensor on the blade using the LED indicators on the Control Box to level it. The sensor should be secured in place where the on-grade green LEDs are lit. Then, lower the blade on to a level or near-level surface, and press the Menu button (Cal. A soft key). The screen will now change to Position 2. While remaining in this screen, turn the machine 180 degrees and lower the blade on the same location as Position 1. Press the Menu button (Cal. B soft key) and if successful, the screen will display the offset. The sensor is now calibrated. If an error message occurs, it means the sensor was not mounted close enough to level. Adjust the sensor to level and restart the calibration procedure.

Filtering - Changing the filtering rate mathematically changes the sensors viscosity. The slower the filtering setting the thicker the sensor fluid will appear. Depending on the machine and the type of work, there will be a need to speed up or slow down the sensor.

Factory settings
Restore Next

Factory Settings: All of the EG Series variables can be restored to their default values by pushing the Restore button. The values saved will be:

Filtering	--I---
On-grade dead band	10mm
Horn	Off
Height Adjustment	-On-
Units of Measurement	mm
Valve type	P.T.
Minimum PW	100ms
Valve Cycle time	250ms
Valve Gain	50%
Derivative Gain	medium
Auto Return	OFF
Language	English

Laser Receiver
Latec Next

Laser Receiver - The EG Series has the ability to communicate with receivers made by other manufacturers. Due to the communication changes necessary, the number of receivers is limited to one in this case. Selections are limited to Apache BullsEye and Topcon LS-B series receivers, each requires an adapter cable to connect to our system.

Pass Change 1000
-> Next

System Lockout Screen - This is the screen where you can enter a new password into the box. The factory default password in every system is “1000”. If the user would like this option to be disabled, set the password to “0000” and all menu options will be available to the user.

English
Change Next

Language - Language options are English or French.

Use 2 Lsr Recvr
Change Next

Number of Receivers - The system needs to know the number of receivers that are connected, one is the default and two is the maximum. If the system is set to two receivers and the second receiver is not connected, the system will be looking for the receiver. Then an error will be displayed, showing the system cant find it.

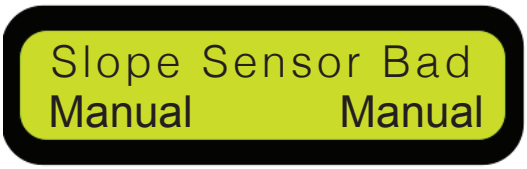
TiltSns-> Valve2
Change Next

Valve2 Select - This selects the device that controls the right valve. The options are the right receiver, the slope sensor, Lr2-Lr1 and disabled. Lr2-Lr1 refers to the difference between the two receiver readings. Most applications will need to select the receiver or tilt sensor to control the right side hydraulics if the height of each side of the blade is controlled individually. However, Lr2-Lr1 should be enabled if your machine controls the blade height with the left side hydraulics and controls tilt with the right.

Valve2 type
Prop time Next

Valve 2 Settings - Valve 2 setting procedures are in the same order as Valve 1, follow the procedure as described for Valve 1.

Software Ver. - This screen is also displayed when the box is first powered on. These version numbers and dates will change as new features are added.



Error Screens: The EG Series control system has built in diagnostics to keep your system running at its peak performance. If a problem develops with the receiver or slope sensor connection, cable, or the device itself, it will be displayed in the main screen.

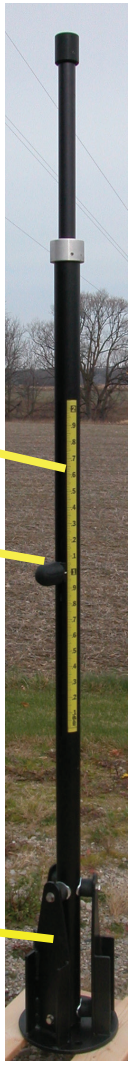
EG Series Options:

EG Series Remote Switch Assy: This enables you to switch your EG2 from auto to manual mode, or raise and lower the valves from the lever in your cab. The switch on the bottom changes the EG Series between Automatic and Manual mode. The switches on the top raise and lower the valves. The switch assembly attaches to any lever using the universal U-bolt assembly.

EG Series Manual Mast:

The manual mast is made from 2” aluminum pipe and the slide can be adjusted up to 30” (760mm). Attach the mast to any implement using the optional Shock Mount Bracket (P#: 102645) or by inserting it into the existing laser mount. The receiver fits on the top of the mast, tighten the receiver into place via the two knobs on the base of the receiver.

Once the mast is mounted onto your machine, loosen the adjustment knob by turning it counter clockwise. Then move the knob up or down, until the receiver picks up a laser hit. Once the receiver has an on-grade laser hit, tighten the mast into place by turning the knob clockwise until it is tight.



Control Box mount:

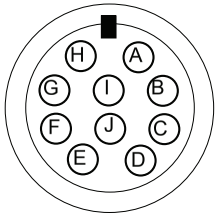
EG Series comes standard with a Ram Mount mounting system that is designed to clamp to a steel rod or to be bolted to a flat surface. This system will allow for flexibility in control box positioning

EG Series Installation:

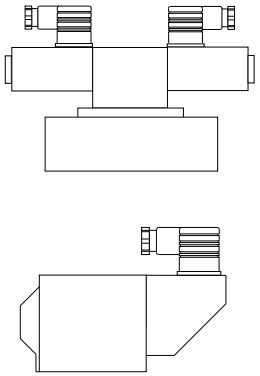
Control Box: To install the control box, find an area in the cab which will allow for it to be easily seen and handled, but not interfere with the operators controls and line of sight. To mount the control box use the supplied mount as a template and drill 4 holes in the appropriate place. Then screw the mount into position and attach the control box to the mount. The control box can now be adjusted for optimal viewing.

Receiver: The receiver can be mounted with any 1 3/4" pipe or with the optional EG2 Manual Mast. It should be mounted so that the receiver can receive a laser hit from 360˚. This means the receiver should clear any cab, stack or any other obstacle on the machine.

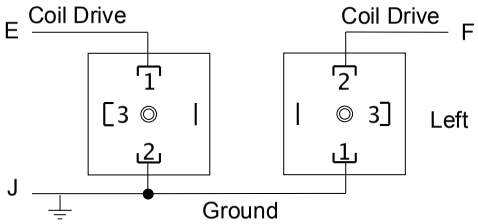
Tilt Sensor: The BS-10 tilt sensor should be plugged into the node cable on the side labelled "Right Side". See page 9 for sensor calibration instructions.

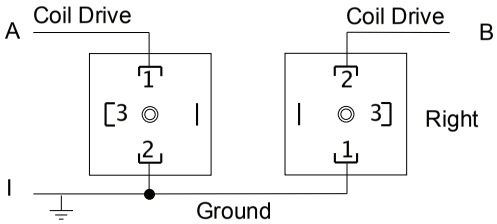


A	- Red/Blk	-	Right valve Lower 1 PT / PWM Out
B	- Brown	-	Right Valve Raise 2 PT / PWM Out
C	- Yellow	-	Right Danfoss / SCV Out
D	- Orange	-	Danfoss/SCV Gnd Referance In
E	- Blue	-	Left Valve Lower 1 PT / PWM Out
F	- Ylw/Blk	-	Left Valve Raise 2 PT / PWM Out
G	- Org/Blk	-	Left Danfoss / SCV Out
H	- Blu/Blk	-	Danfoss/SCV +V Referance In
I	- Black	-	Ground
J	- Red	-	Ground



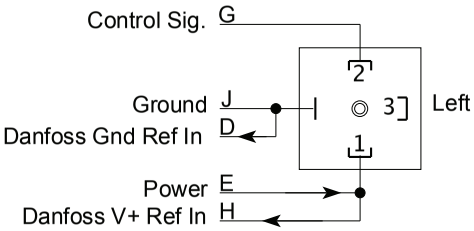
Proportional Time & 200, 100, 50 Hz Proportional Current:

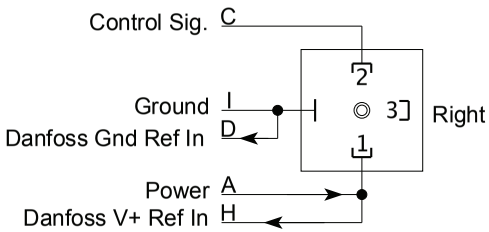




Proportional Voltage PVE (Danfoss) top valve connector view:

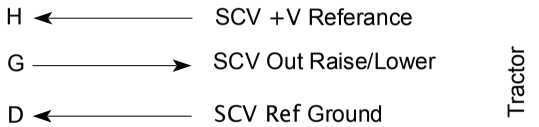
Valve connector has male pins, drawn below.

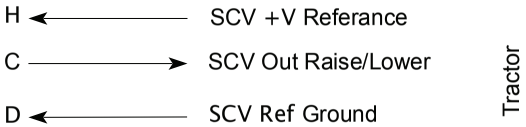




Selective Control Valve:

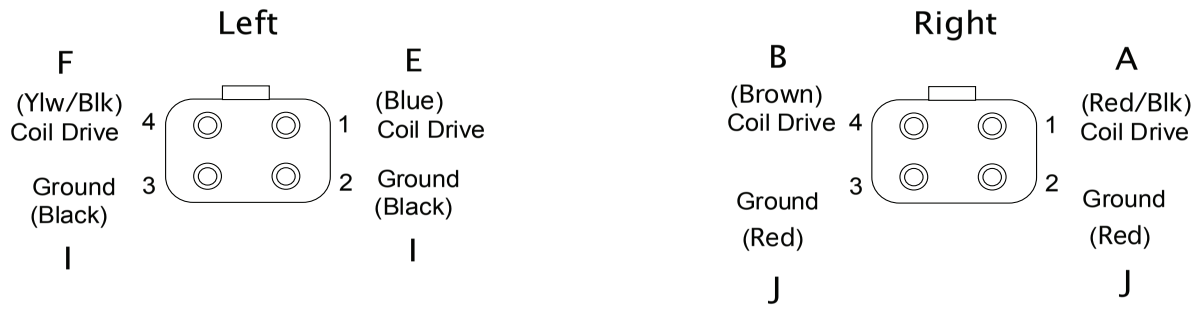
SCV





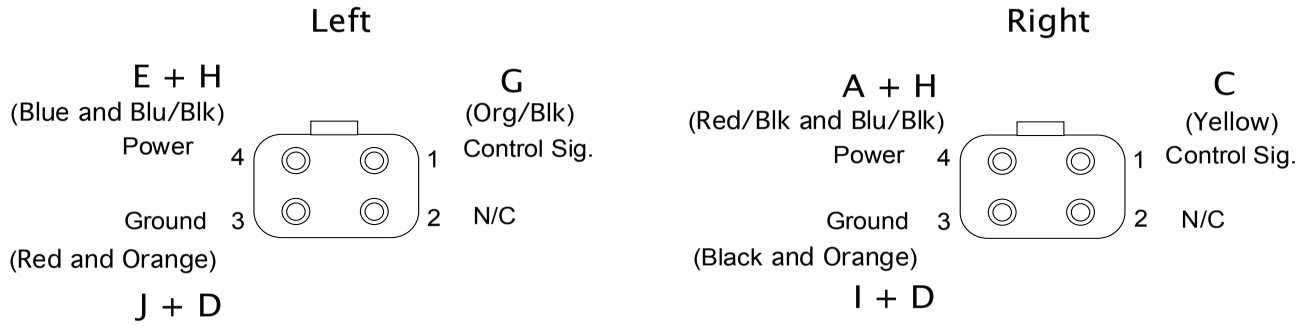
Deutsch Connector – Posterior View of Plug

Proportional Time/Current

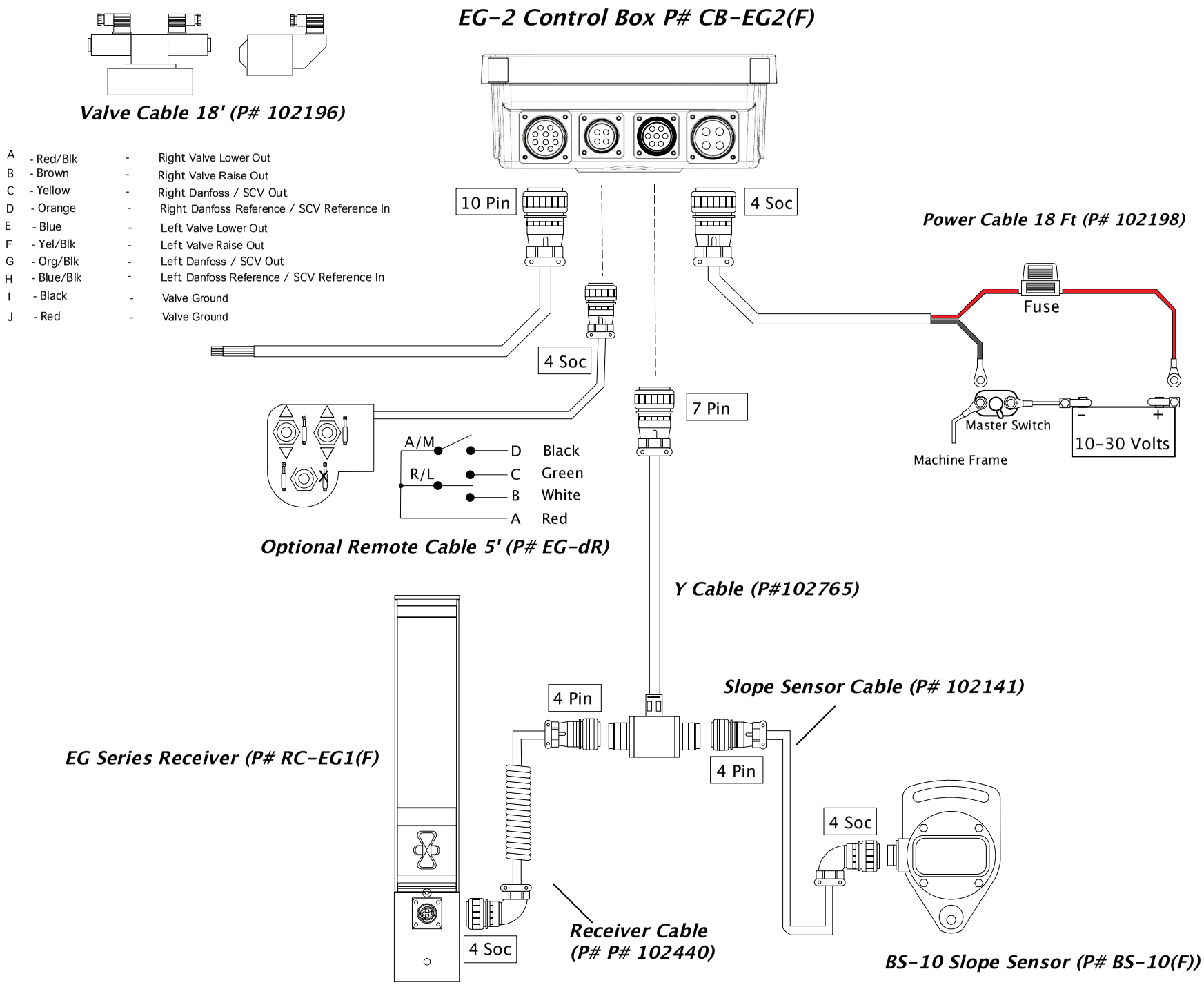


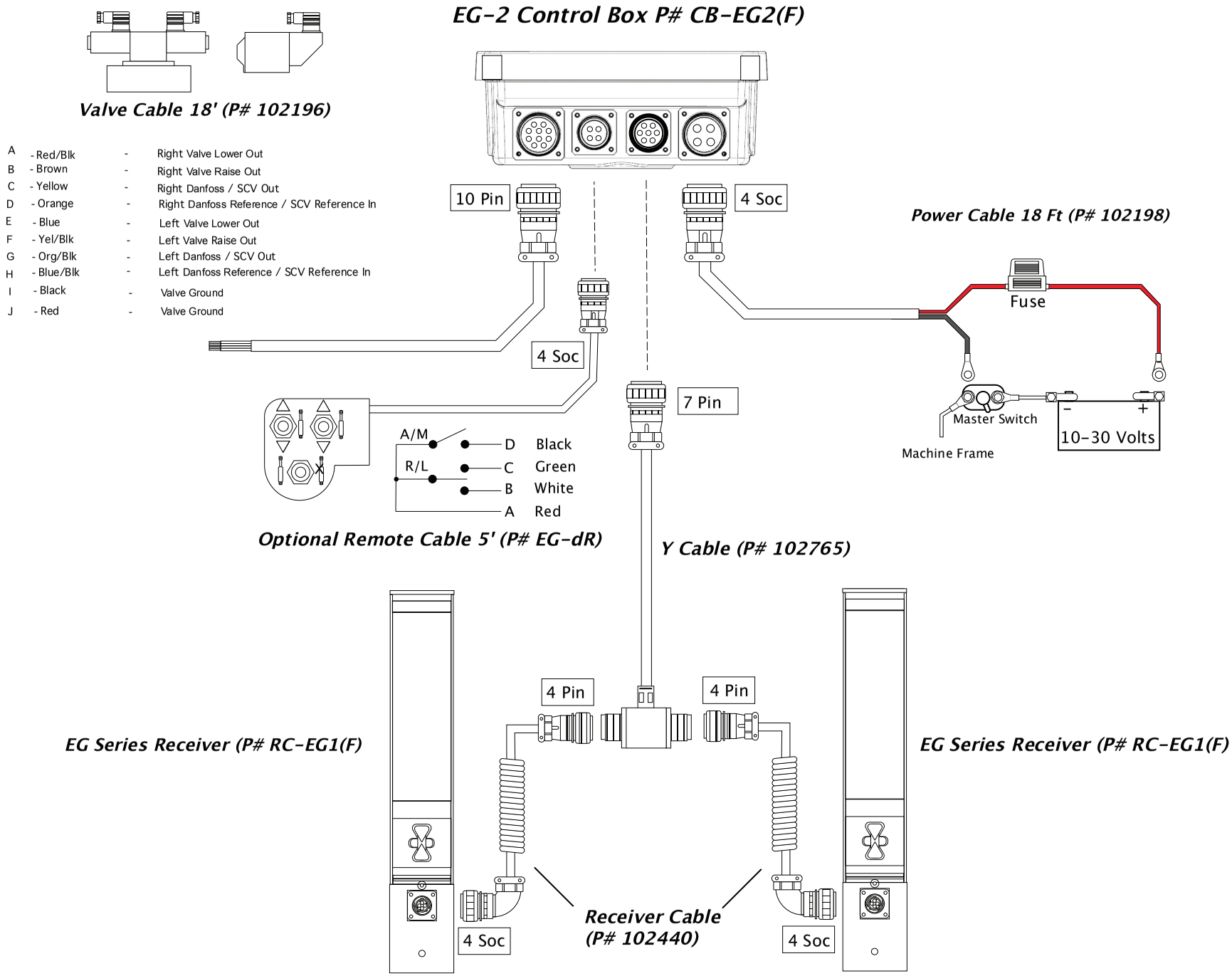
Deutsch Connector – Posterior View of Plug

Proportional Voltage PVE (Danfoss)



SCV Selective Control Valve


EG-2 Control Box P# CB-EG2(F)
Valve Cable 18' (P# 102196)
A - Red/Blk - Right Valve Lower Out
B - Brown - Right Valve Raise Out
C - Yellow - Right Danfoss / SCV Out
D - Orange - Right Danfoss Reference / SCV Reference In
E - Blue - Left Valve Lower Out
F - Yel/Blk - Left Valve Raise Out
G - Org/Blk - Left Danfoss / SCV Out
H - Blue/Blk - Left Danfoss Reference / SCV Reference In
I - Black - Valve Ground
J - Red - Valve Ground
10 Pin
4 Soc
Power Cable 18 Ft (P# 102198)
Fuse
4 Soc
7 Pin
Master Switch
Machine Frame
10-30 Volts
A/M
R/L
D Black
C Green
B White
A Red
Optional Remote Cable 5' (P# EG-dR)
Y Cable (P#102765)
Slope Sensor Cable (P# 102141)
4 Pin
4 Pin
EG Series Receiver (P# RC-EG1(F)
4 Soc
4 Soc
Receiver Cable
(P# P# 102440)
BS-10 Slope Sensor (P# BS-10(F))


EG-2 Control Box P# CB-EG2(F)
Valve Cable 18' (P# 102196)
A - Red/Blk - Right Valve Lower Out
B - Brown - Right Valve Raise Out
C - Yellow - Right Danfoss / SCV Out
D - Orange - Right Danfoss Reference / SCV Reference In
E - Blue - Left Valve Lower Out
F - Yel/Blk - Left Valve Raise Out
G - Org/Blk - Left Danfoss / SCV Out
H - Blue/Blk - Left Danfoss Reference / SCV Reference In
I - Black - Valve Ground
J - Red - Valve Ground
10 Pin
4 Soc
4 Soc
Power Cable 18 Ft (P# 102198)
Fuse
Master Switch
Machine Frame
10-30 Volts
7 Pin
A/M
R/L
D Black
C Green
B White
A Red
Optional Remote Cable 5' (P# EG-dR)
Y Cable (P# 102765)
4 Pin
4 Pin
EG Series Receiver (P# RC-EG1(F)
EG Series Receiver (P# RC-EG1(F)
4 Soc
4 Soc
Receiver Cable
(P# 102440)

Notes

Warranty

This EG Series system is warranted to the original purchaser to be free from defects in workmanship and material. Latec Machine Control will repair or replace any defective part which may malfunction under normal and proper use within a period of **ONE YEAR** from the date of purchase without charge for parts and labour, once delivered and shipped prepaid to Latec Machine Control together with proof of date and place of purchase. This warranty is not subject to misuse, abuse, assignment, or transfer. The exclusive remedy under any and all warrants and guarantees, expressed or implied, is limited to repair and/or replacement as provided herein, and Latec Machine Control shall not be liable for damages from loss or delay of equipment uses, consequential, or incidental damage.

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