NATIONAL ELECTROSTATICS CORP.

Instruction Manual No. 2HT072920 for
Operation and Service of

TURBO PUMP STATION INTERLOCK CONTROLLER

2HA072920

8/18/08
AJG

P.O. Box 620310, Middleton, WI, 53562-0310, Phone: 608-831-7600, FAX: 608-831-9591, E-Mail: nec@pelletron.com

TABLE OF CONTENTS

ELECTRICAL SAFETY INSTRUCTIONS

IMPORTANT SAFETY INFORMATION
READ BEFORE OPERATION AND SERVICE

SHOCK HAZARD WARNING
THIS UNIT USES AC MAINS POWER
THIS UNIT CONTAINS DANGEROUS VOLTAGES AND ENERGY

This unit must only be operated and serviced by qualified personnel who have read the instruction manual and are familiar with the hazards associated with dangerous voltages. Proper care and judgment must always be observed.

OPERATION:

1. Before connecting input AC power, ensure that all covers are in place and securely fastened. Ensure that the required safety ground to the chassis is installed (indicated by the protective ground symbol) and sufficient cooling is supplied.

2. Proper grounding from the input AC power is required to reduce the risk of electric shock and to comply with safety agency and code requirements.

3. Use caution when connecting input AC power. Only apply the input voltage specified on the rating label.

4. Use caution when connecting any high voltage cables. Never handle any output cables when the unit is energized.

5. After the unit is switched off, dangerous voltages may remain on the outputs. Allow sufficient time for self-discharge before handling anything connected to an output. The user's load must be taken into consideration when determining the time required. Use a mechanical ground when possible.

6. When user serviceable fuses are present, always replace fuses with the same type and volt/amp rating.

7. Never attempt to operate the unit in any manner not described in the instruction manual.

8. Never remove warning labels from the unit. Replace lost or damaged labels immediately. Contact NEC for replacement labels.

SERVICE:

The following safety labels apply to this unit:

CAUTION - Risk of electrical shock

Protective Ground Conductor

1. Service is best done by NEC trained technical personnel, either at the site during installation or by returning the unit to the NEC factory. Call NEC at 608-831-7600 for a Return Materials Authorization (RMA) number and ship unit to 7540 Graber Road, Middleton, WI 53562.

2. If service of this unit is to be done at the user's site, this service may only be performed by trained and qualified personnel and must follow instructions from this manual or from NEC technical personnel.

3. Consult NEC supplied assembly drawings, parts lists, circuit board drawings and schematic diagrams for service details.

I. GENERAL DESCRIPTION

The Turbo Pump Station Interlock Controller provides interlock protection for one or two Turbo Pump Stations. The Turbo Pump(s), Gate Valve(s), and Rough Valve are all interlocked to provide for safe, unsupervised operation. In the event of Turbo Pump shutdown, the Gate Valve(s) will automatically close preserving the integrity of the vacuum system. In addition, the Rough Valve will be closed. Turbo Pump power is interlocked to the Rough Valve, but can be bypassed via a locking switch on the rear panel. A green LED on the front panel indicates when power is being supplied to the Turbo Pump controller. This controller requires operator intervention for the Turbo Pump to power back on after an interlock failure or after loss of AC power. A connector on the rear panel provides status reads for remote monitoring of the Interlock Controller.

In addition to providing interlock protection, this controller provides manual control for both the Rough Valve and Gate Valve(s). Provision has been made to bypass the interlocks with a switch on the front panel when initially starting up the Turbo Pump or when interlock protection is not desired. A red LED clearly indicates the Bypass condition. A rear panel locking switch selects whether the controller will automatically return to Interlock mode after the interlock(s) have been satisfied.

II. SPECIFICATIONS

Size:	Half rack mount unit, 8.25" wide by 5.25" high by 12.0" deep
AC Power Input:	90 to 260 VAC 1150 VA max., 47-63 Hz
AC Power Fusing:	5 Ampere 3AG or 5x20 mm type “T” Slo-Blo
24 VDC Power Fusing:	1 Ampere 3AG
Turbo Power:	1) Switched 90 to 260 VAC for Turbo #1 (equal to the AC Power Input to the controller) and 2) Switched 24 VDC Nominal Output for control of Turbo #2
Rough Valve Control:	24 VDC Nominal Output provided to open Rough Valve
Gate Valve Control:	24 VDC Nominal Output provided to open Gate Valve (provision for control of two valves)
Turbo Pump NLK:	Contact closure or 24 VDC required to indicate Turbo Pump NLK OK (i.e. attained full rotational speed)
Auxiliary NLK:	Contact closure required to indicate Aux NLK OK (note: must be jumpered if not used)
Rough Valve SR:	Contact closure required to indicate that the Rough Valve is open (note: pins 2 and 7 of J4 must be jumpered if a position SR is not used on the valve)
Remote SR:	24 VDC Nominal Output to indicate status of 1) Turbo Pump NLK 2) NLK Bypassed 3) Gate Valve Open 4) Rough Valve Open

III. INSTALLATION

The Turbo Pump Station Interlock Controller is intended to be installed in a 5.25" equipment rack next to the Turbo Pump controller. Using the appropriate connectors and cables, make connections to the unit as follows. For connection to a single Turbo Pump controller reference Figure 1. For connection to dual Turbo Pump controllers reference Figure 2. Note that other configurations for connection to dual Turbo Pump controllers do exist.

1. AC Power (PR1)

   The Turbo Pump Station Interlock Controller is designed to operate on 90-260 VAC (50 or 60 Hz) power. The unit requires a 5 Ampere SLO-BLO fuse for 90-260 VAC operation. 3AG or 5x20 mm type T fuses may be used. 3AG is the default fuse size. Connect the unit to a grounded 50 or 60 Hz service circuit. The AC power cord has the following color code:

Power Cord Wire Color	Function
Black	Hot (Line)
White	Neutral
Green	Ground

CAUTION: Do not operate Turbo Pump Station Interlock Controller without a good external ground attached to the rear panel ground stud.

2. Turbo Power Connector (J1)

This connector provides switched AC power for the Turbo Pump controller. The 3 pin (female) CEE-22 power receptacle has the following pin assignments:

Turbo Power Connector (J1)	Function
Pin H	Turbo Power Hot
Pin N	Turbo Power Neutral
Pin G	Turbo Power Ground

Use a #16 AWG, 3 conductor line cord with IEC320 male plug (Belden #17625 or equivalent) for connection to J1.

3. Turbo NLK Connector (J2)

The Turbo NLK SR is intended to be connected to a turbo pump controller status read indicating the Turbo Pump has attained its full rotational speed. Any other connection may negate the interlocking features of this controller. The 9 pin (female) "D" connector has the following pin assignments:

Turbo NLK Connector (J2)	Function
Pin 1	+24 VDC
Pin 2	Turbo NLK SR (+)
Pin 7	Turbo NLK SR (-)
Pin 6	Common
Pin 5	Shield

For connection to a turbo pump controller that provides 24 VDC use pins 2 and 7 (note proper polarity). If the turbo pump controller provides a contact closure, jumper pins 6 and 7. Connect pins 1 and 2 to the contacts. Use a #24 AWG, one twisted pair shielded cable (Belden #9501 or equivalent) for connection to J2.

4. Auxiliary NLK Connector (J3)

The Auxiliary NLK SR is intended to provide an additional Turbo Pump Station interlock such as an Ion Gauge Controller SR. Connection to J3 is optional and not required. However, if no Auxiliary NLK is desired, then pins 1 and 2 must be jumpered. Jumper Plug 2XL104312 accomplishes this function. In cases where a second Turbo Pump is used, this connector provides the Turbo #2 NLK SR. The 3 pin (female) miniature audio connector has the following pin assignments:

Aux NLK Connector (J3)	Function	
Pin 1	Aux NLK SR	) Jumper required) if Aux NLK is
Pin 2	Aux NLK SR	) not used
Pin 3	Shield	

Use a #24 AWG, one twisted pair shielded cable (Belden #9501 or equivalent) for connection to J3.

5. Rough Valve Connector (J4)

This connector provides for connection to the Rough Valve solenoid. The Rough Valve SR can be connected to a position SR to verify valve operation. However, if no position SR is used, pins 2 and 7 need to be jumpered. The 9 pin (female) "D" connector has the following pin assignments:

Rough Valve Connector (J4)	Function
Pin 1)) Pin 6)	Rough Valve SC
Pin 2)) Pin 7)	Jumper required if Rough Valve SR is not used
Pin 3)) Pin 8)	Rough Valve SR
Pin 5	Shield

Use #24 AWG, one twisted pair shielded cable(s) (Belden #9501 or equivalent) for connection to J4.

6. Gate Valve/Turbo #2 Connector (J5)

This connector provides for connection to the Gate Valve solenoid. There is provision for connection to a second Gate Valve solenoid and for connection to a relay coil for energizing power to the second Turbo Pump controller. The 9 pin (female) "D" connector has the following pin assignments:

Gate Valve/Turbo #2 Connector (J5)	Function
Pin 1)	Gate Valve SC
Pin 6)	Gate Valve SC
Pin 2)	Gate Valve #2 SC
Pin 7)	Gate Valve #2 SC
Pin 3)	Turbo Power #2 SC
Pin 8)	Turbo Power #2 SC
Pin 4)	+24 VDC
Pin 9)	Common
Pin 5	Shield

Use #24 AWG one twisted pair shielded cable(s) (Belden #9501 or equivalent) for connection to J5.

7. Remote SR Connector (J6)

This connector provides for remote monitoring of the status of signals used by the Turbo Pump NLK Controller. The 9 pin (female) "D" connector has the following pin assignments:

Remote SR Connector (J6)	Function
Pin 1)	Turbo Pump NLK SR (+24V)
Pin 6)	Turbo Pump NLK SR (Common)
Pin 2)	NLK Bypassed SR (+24V)
Pin 7)	NLK Bypassed SR (Common)
Pin 3)	Gate Valve Open SR (+24V)
Pin 8)	Gate Valve Open SR (Common)
Pin 4)	Rough Valve Open SR (+24V)
Pin 9)	Rough Valve Open SR (Common)
Pin 5	Shield

Use #24 AWG four twisted pair shielded cable (Belden #9504 or equivalent) for connection to J6.

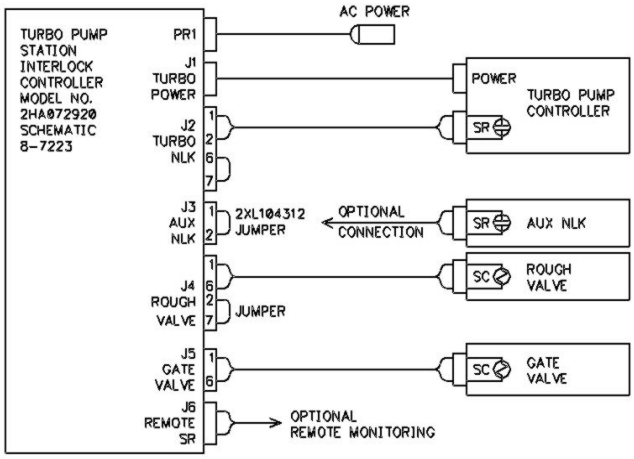

FIGURE 1: CONNECTION TO SINGLE TURBO PUMP CONTROLLER

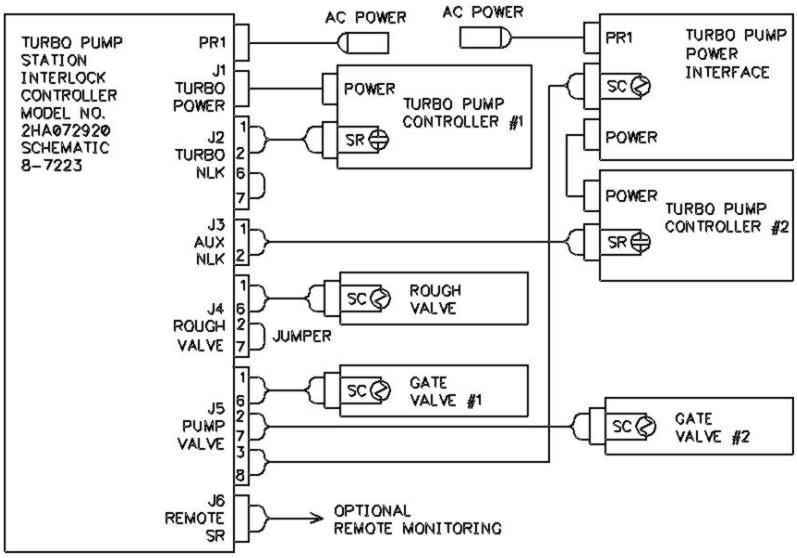

FIGURE 2: CONNECTION TO DUAL TURBO PUMP CONTROLLERS
W/ TURBO CONT POWER INTERFACE

IV. **OPERATION**

Reference Figure 3 for the location of front panel controls and indicators. Reference Figure 4 for the location of rear panel controls and connectors.

1. Initial Startup of Turbo Pump Station:

   Check that the Roughing Pump is On. Toggle Power switch on Turbo Pump Station Interlock Controller to On. The Power On LED should light yellow. Momentarily toggle Interlock switch to Start/Bypass. The Bypass LED should light red. Momentarily toggle Rough Valve switch to Open. The Rough Valve Open LED should light green. The Turbo Power LED should also light green, indicating that power is being supplied to the Turbo Pump controller. Switch the power on to the Turbo Pump controller and start up the turbo pump.

2. Auto Return to Interlock:

   To have controller automatically cancel Bypass and return to Interlock mode, toggle the locking Auto Return to Interlock switch on the rear panel to Auto NLK. (Note: This is the default position as shipped from the factory.) When the Turbo Pump NLK and Auxiliary NLK have been satisfied, the Interlock OK LED should light green. With Interlock OK and the Rough Valve Open, opening the Gate Valve will automatically cancel Bypass and engage Interlock mode. If this feature is not desired, toggle rear panel Auto Return to Interlock switch to Off. The operator can then choose to enter Interlock mode by momentarily toggling the front panel switch to Interlock.

CAUTION: Under normal operating conditions one should operate in Interlock mode. Bypass mode is intended for initial startup of the Turbo Pump Station when the interlock must be bypassed, and for temporary, short-term operation which is supervised. Overnight operation should be interlocked.

3. Operation of Rough Valve:

This controller provides for manual control of a Rough Valve. Momentarily toggling the Rough Valve switch to Open will open the Rough Valve. The Rough Valve LED's should change from Closed (red) to Open (green). Momentarily toggling the Rough Valve switch to Close will close the Rough Valve. The Rough Valve LED's should change from Open (green) to Closed (red). The Rough Valve circuitry requires that either the Turbo NLK and Auxiliary NLK be satisfied or that the controller be in Bypass mode. The Rough Valve must be open for Turbo Pump power to be on unless bypassed via the locking Rough Valve Interlock Bypass switch on the rear panel. (Note: The default position for this switch is Rough NLK.) After an interlock failure or after loss of AC power, Turbo Pump power remains latched off.

CAUTION: Under normal operating conditions one should operate in Rough Valve Interlock mode. Prolonged operation of the Turbo Pump without the Rough Valve open will damage the Turbo Pump. Rough Valve Interlock Bypass mode is intended for short-term, supervised operation only. In this mode, power will be supplied to the Turbo Pump controller as soon as Bypass mode is engaged.

4. Operation of Gate Valve:

This controller provides for manual control of one or two Gate Valves. Momentarily toggling the locking Gate Valve switch to Open will open the Gate Valve(s). The Gate Valve LED's should change from Closed (red) to Open (green). Momentarily toggling the Gate Valve switch to Close will close the Gate Valve(s). The Gate Valve LED's should change from Open (green) to Closed (red). The Gate Valve circuitry requires that either the Turbo NLK and Auxiliary NLK be satisfied or that the controller be in Bypass mode.

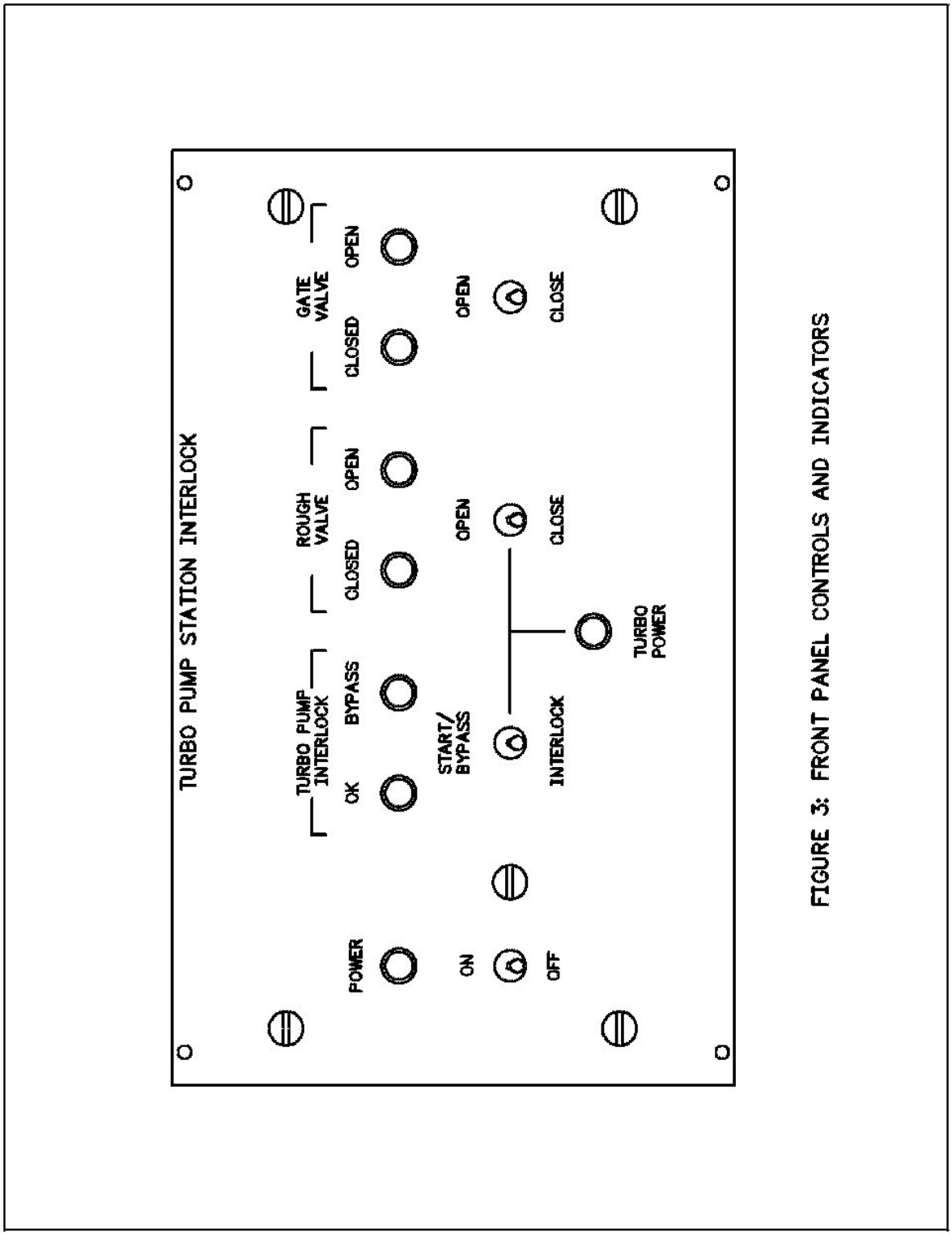

FIGURE 3: FRONT PANEL CONTROLS AND INDICATORS

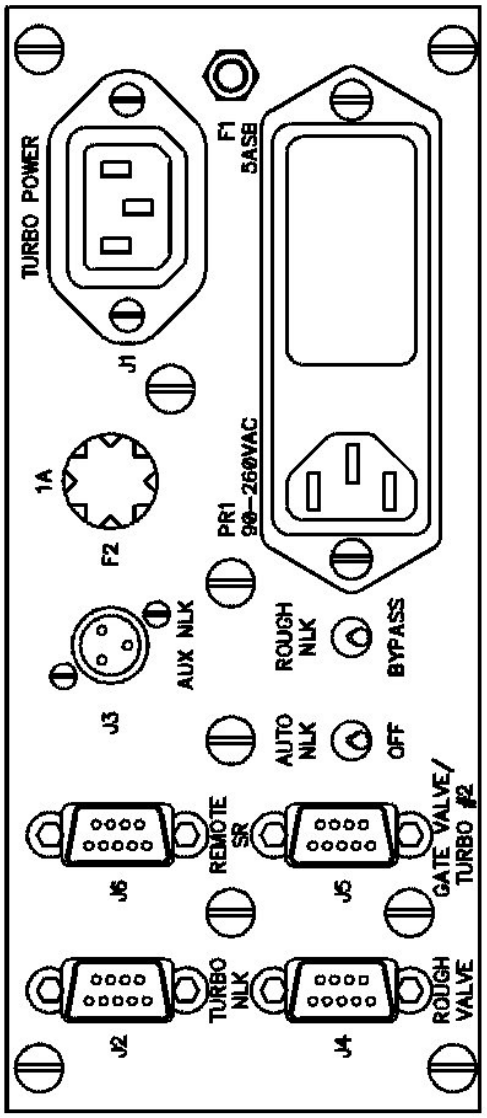

FIGURE 4: REAR PANEL CONTROLS AND CONNECTORS

V. DOCUMENTATION

Turbo Pump Station Interlock Controller - Assembly	Drawing No. 2HA072920 Parts List No. 2HA072920
Turbo Pump Station Interlock Controller - Schematic	Drawing No. 2HS072230
Turbo Pump Interlock P.C. Board - Assembly	Drawing No. 2HR072020 Parts List No. 2HR072020
Turbo Pump Interlock P.C. Board - Schematic	Drawing No. 2HS072240