

Training Yard Control Panel

Bulletin 1100: User Manual





IMPORTANT USER INFORMATION

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Timpson Electrical & Aerial Services, LLC be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Timpson Electrical & Aerial Services, LLC cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Timpson Electrical & Aerial Services, LLC with respect to use of information, circuits, equipment, or software described in this manual.

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SUMMARY OF CHANGES

This manual may contain new and updated information. Changes throughout this manual will be listed below:

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NOTES:



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1. Users

a. Intended Users

- This system is intended for the following users:
 - Linemen Trainer
 - Linemen Trainees

b. Needs That This Unit Satisfies

- Provides the Lineman trainer and trainee, with adequate real-world High-Voltage scenarios, while maintaining safety for the trainer, trainee, and the training integrity of the company.



2. Training Panel Highlights and Description

- a. Processor scan times:
 - i. Bit Operations: 0.08 μ s/instruction;
 - ii. Word Operations: 1.7 μ s/instruction;
 - iii. Real Operations: 2.3 μ s/instruction;
 - iv. Average Scan Time: 1-2 ms/program cycle

- b. Safety Relay Info:
 - i. Release Time: 20 ms

- c. Mean Time to Open Upon Detected Fault:
 - i. Average Scan Time + Safety Relay Release Time + Electrical Current in Conductor Time (Negligible) = Safety Response Time;
 - ii. 25 ms + 20 ms + \sim 1 ms \cong 31 ms

- d. Safety Ratings:
 - i. Fail Safe I/O: SIL Level 3 (per IEC 61508);
 - ii. Safety Relay (Master) SIL Level 3 (per IEC 62061);
 - iii. Safety Relay (Redun.) SIL Level 2 (per IEC 62061)

- e. Safety Integrity Level (SIL) Info:
 - i. Probability of Failure per Hour:
 - 1. SIL Level 3: 0.000 000 1 – 0.000 000 01 (10^{-7} - 10^{-8});
 - 2. SIL Level 2: 0.000 001 – 0.000 000 1 (10^{-6} - 10^{-7})



- f. International Electro-technical Commission (IEC) Info:
 - i. IEC 61508 – Electrical Safety of Electrical/Electronic/Programmable safety related systems;
 - ii. IEC 62061 – Safety for Machinery

- g. Current Transducer & Analog Input Incremental Resolution:
 - i. Current Transducer: 0-5A
 - ii. Analog ADC: 13-bit
 - iii. $(5-0)/(2^{13}) = 5/8192 = 0.0006A = 600\mu A$ increments

- h. Misc. Safety Info:
 - i. Main Disconnect Handle allows (3) simultaneous Lock-Out-Tag-Out systems;
 - ii. System reset and initialization requires a supervisory key;
 - iii. High-Voltage Energize pushbutton is protected under a pad-lockable safety cover;
 - iv. System Safe/Off pushbutton utilizes redundant normally closed contacts, one of which is Normally Closed Self-Monitoring;
 - v. E-Stop Pushbuttons utilize SIL3 redundant sets of normally closed contacts, one of which is Normally Closed Self-Monitoring;
 - vi. Master Safety relay can only be reset by inserting the supervisory key and indexing the RESET selector switch to the Safety position – the controller cannot reset the safety relay via program. (The master safety relay must be reset once power is applied to the panel before operation can commence.);
 - vii. Panel doors have coded magnetic door switch with SIL3 redundant N.C. contacts in line with the master safety relay;
 - viii. High-Voltage is physically isolated inside control panel from low voltage.



3. Operational Sequence

a. System Pre-Check

- i. Determine that the training yard is free and clear of persons, animals, and misc. debris that are not intended for use as described herein.
- ii. Verify that all PPE and safety protocols & procedures are in place.
- iii. Confirm that the transformer dead-front is installed properly in the panel over the High-Voltage section of the panel.
- iv. Verify that both doors on the control panel are closed and locked.
- v. Announce that the Training Yard is in the process of becoming energized.

b. System Usage

- i. Remove the Lock-Out-Tag-Out provisions that are currently on the Main Disconnect handle.
- ii. Index the Main Disconnect handle to the ON position.
 1. Note that the unit, once energized, will enter into a self-check mode before entering into the run mode. This self-check mode, will take approximately 30-seconds after the processor starts.
- iii. While the unit is in Self-Check mode, the Safety Circuit Disabled and Heartbeat pilot lights will alternate flashing. Once the unit has successfully exited the Self-Check mode, the Heartbeat and System Alarm pilot lights will flash, and the Safety Circuit Disabled light will illuminate.
- iv. Verify that all Emergency Stop pushbuttons are pulled outward and disengaged.
- v. Depress the Light/Horn Test pushbutton to verify all pilot lights and audible horns are operational. It should be noted that the horn will only energize for 2-seconds.
- vi. Insert the Operator Key into the Reset selector switch and index toward the Safety position, resetting the main Safety Relay. If the main Safety Relay is energized, the Safety Circuit Disabled pilot light will extinguish.
- vii. Index the Reset selector switch toward the Alarm position, resetting any current system alarms.



- viii. At this point the unit should be ready to energize the yard, verify the following:
 - 1. Heartbeat Pilot Light is flashing at a 1-second interval;
 - 2. High-Voltage Energized pilot light is OFF;
 - 3. System Alarm pilot light is OFF, and;
 - 4. Safety Circuit Disabled pilot light is OFF.
- ix. After verification of step viii, remove the pad-lock from the Energize High-Voltage pushbutton.
- x. Verify that the yard and lines are clear, and depress the Energize High-Voltage pushbutton. After the pushbutton is depressed, the following will happen:
 - 1. The Audible Horn will sound four times;
 - 2. The secondary Safety Relay will engage, energizing the yard, and;
 - 3. The High-Voltage Energized pilot light and any field Beacons will illuminate.
- xi. The system will continue to energize the High-Voltage until one or more of the following happen:
 - 1. A E-Stop pushbutton is depressed;
 - 2. Power is disconnected to the unit, or;
 - 3. The operator depresses the System Off/Safe pushbutton;
 - 4. The unit trips out on overcurrent detection.
- xii. To reset and/or re-energize the unit, use the following instructions:
 - 1. A E-Stop pushbutton is depressed:
 - a. Go to instruction iv
 - 2. Power is disconnected to the unit, or:
 - a. Go to instruction ii
 - 3. The operator depresses the System Off/Safe pushbutton or the unit trips out on overcurrent detection:
 - a. Index the Reset selector switch key to the Alarm position to clear the current status.
 - b. You will now be able to re-energize the yard by depressing the Energize High-Voltage pushbutton.



c. System Shut-Down

- i. The system will continue to operate until one or more of the following happen:
 1. An E-Stop pushbutton is depressed;
 2. Power is disconnected to the unit, or;
 3. The operator depresses the System Off/Safe pushbutton;
 4. The unit trips out on overcurrent detection.
- ii. To properly shut-down the Training Yard panel, follow the steps as outlined below:
 1. Depress the System Off/Safe pushbutton;
 2. Index the Main Disconnect handle to the OFF position;
 3. Replace the pad-lock on the Energize High-Voltage pushbutton cover;
 4. Remove the Operator Key from the Reset selector switch, and;
 5. Replace the Lock-Out-Tag-Out provisions on the Main Disconnect handle.



4. System Alarms

a. Critical Alarms

- i. Critical Alarms are as follows:
 1. Incoming supply voltage is out-of-range (generally 5-10%);
 2. Safety Relay response and/or feedback time is out of spec;
 3. DC Power Supply Health is poor;
 4. Transformer Overcurrent Protection is tripped, and;
 5. The Door Safety Switch is not made.
- ii. Annunciation of Critical Alarms:
 1. If a Critical Alarm is detected during the Self-Check mode, the unit will enter into a non-permissive mode and will not run until the system is diagnosed and the alarm is cleared.
 2. If a Critical Alarm is detected during system operation, the System Alarm pilot light will flash at 0.5-second intervals. The unit will not run until diagnosed and cleared.
- iii. In the event of a Critical Alarm, please contact the Timpson Electrical & Aerial Services, LLC. Technical Support team at: (443) 945-3234.

b. Non-Critical Alarms

- i. Non-Critical Alarms are as follows:
 1. Overcurrent detection as set during system start-up.
- ii. Annunciation of Non-Critical Alarms:
 1. Audible Horn will sound for 2-seconds;
 2. System Alarm pilot light will flash at a 1-second rate.
- iii. In the event of a Non-Critical Alarm, please refer to section 3.b "System Usage."



c. System Alarm Pilot Light

- i. The following flash frequencies are used to determine the type of alarm state:
 1. 2-second rate (0.5Hz): Safety system acknowledgement required. Index the Reset selector switch to the Alarm position to acknowledge.
 2. 1-second rate (1.25Hz): Non-critical alarm. Index the Reset selector switch to the Alarm position.
 3. 0.5-second rate (2Hz): Critical alarm. Disconnect power to the unit for at least one minute. Re-energize unit and allow the system to enter into Self-Check mode. Should the system become locked up in Self-Check mode, test the supply voltage and contact Timpson Electrical & Aerial Services Technical Support.



5. Troubleshooting

a. Troubleshoot the Installation

- i. Unit does not energize when Main Disconnect handle is indexed to the ON position.
 1. Verify incoming voltage is present on all phases. Check the panel nameplate for system requirements.
 2. Test fuses in Main Disconnect switch. If needed, replace with the same class fuses, paying attention to: Class, Voltage, and Amperage.
- ii. Unit does not energize the high-voltage lines when the system indicates “High-Voltage Energized.”
 1. Verify the transformers are wired to the yard correctly per the installation instructions and wiring diagram included with installation documents.

b. Troubleshoot the Operation

i. Pilot Light Indication

1. “Control Power On” – Energized when 24vdc is present inside the control panel.
2. “Heartbeat” - Flash rates below:
 - a. 2-second rate (0.5Hz): System pre-check complete and system is not ready;
 - b. 1-second rate (1.25Hz): System ready;
 - c. 0.5-second rate (2Hz): System critical alarm.
3. “High-Voltage Energized” – 1-second flash rate (1.25Hz), the system detects, either via operator intent, or otherwise sensed, that the High-Voltage is, or could become, energized. Whether or not the operator has intended to energize the High-Voltage, if this pilot light is illuminated, take all necessary precautions.
4. “System Alarm” – Flash rates below:
 - a. 2-second rate (0.5Hz): Safety system acknowledgement required. Index the Reset selector switch to the Alarm position to acknowledge.
 - b. 1-second rate (1.25Hz): Non-critical alarm. Index the Reset selector switch to the Alarm position.



- c. 0.5-second rate (2Hz): Critical alarm.
5. “Safety Circuit Disabled” – When illuminated, the system has sensed, via redundant feedback loops, that the Main Safety Relay has been de-energized and is in the OPEN state.
6. One or more of the pilot lights do not light up when I depress the “Light/Horn Test” pushbutton – All pilot lights are LED, and should not burn out before the life of the system. However, if one or more are not operational during the test, do not continue operating the system. Disable power and contact Timpson Electrical & Aerial Services, LLC technical support.

ii. System Operation Issues

1. System locks up during Self-Check mode - The system will not exit the Self-Check mode if one or more of the following conditions are detected:
 - a. DC Power Supply Health is poor.
 - b. Transformer overcurrent protection is OFF or TRIPPED.
 - c. The enclosure door safety switch circuit is not made.
 - d. The incoming supply voltage is out of range.
 - e. One or more of the secondary safety relays have failed their feedback test.
2. Cannot close the safety circuit for system use (cannot get “Safety Circuit Disabled” pilot light to extinguish):
 - a. Check that all E-Stop Mushroomhead pushbuttons are pulled outward.
 - b. System is in Critical Alarm mode.
 - c. Transformer overcurrent protection is tripped.
 - d. Enclosure door sensor is not made.
 - e. SIL3 safety block in processor requires acknowledgement. Index the Reset selector switch to the Alarm position.
3. Cannot energize High-Voltage:
 - a. System is not ready – reset the Main Safety Relay.
 - b. System has a non-critical alarm. Index the Reset selector switch to the Alarm position.



c. Determining the Software Version

- i. The software version on units without an HMI Touchscreen can be found on a label placed on the processor. This information is important to have on-hand before calling Tech-Support for assistance.



6. Recommended Spare Parts List

The following items are items that are recommended to be kept on-hand to help keep downtime to a minimum. These items can be purchased from Timpson when your unit is ordered, or shortly after Start-Up & Commissioning. With the assistance of Timpson technical support, below are items which can be troubleshot over the phone and replaced by the end-user.

- i. Operator Safety Switch Keys
- ii. Main Disconnect Fuses
- iii. Voltage Transducer Fuses
- iv. Transient Voltage Surge Suppressor Module
- v. Audible Horn
- vi. Remote Beacon
- vii. Operator Pilot Lights



7. Warranty Statement

Timpson Electrical & Aerial Services, LLC. warrants the equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to replacing at its factory any product, part, or parts thereof which shall, within one year after delivery of such equipment to the original purchaser, be returned, and which Timpson Electrical & Aerial Services, LLC.'s examination shall disclose to its satisfaction to have been defective. Except for the warranty hereinbefore stated TIMPSON ELECTRICAL & AERIAL SERVICES, LLC. MAKES NO WARRANTY EXPRESSED OR IMPLIED; ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE IS HEREBY DISCLAIMED BY TIMPSON ELECTRICAL & AERIAL SERVICES, LLC. AND EXCLUDED FROM ANY AGREEMENT MADE BY ACCEPTANCE OF ANY ORDER PURSUANT TO OUR QUOTATION. THERE ARE NO WARRANTIES, EXPRESSED OR IMPLIED, WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. Timpson Electrical & Aerial Services, LLC. neither assumes nor authorizes any person to assume for it any other liability in connection with the sale of its equipment. This warranty will not apply to any equipment which has been modified outside of its factory in any way so as, in Timpson Electrical & Aerial Services, LLC.'s judgment, to affect its stability, or reliability, nor which has been subject to misuse, negligence, or accident or to improper operation or storage, or to other than normal use or service. Timpson Electrical & Aerial Services, LLC. shall not be held liable for damages, direct or consequential, or delays, if such occurs on account of defective materials, or workmanship, or delays in shipment. Timpson Electrical & Aerial Services, LLC. will not grant any allowance for any repairs of alterations made without written consent of an officer of Timpson Electrical & Aerial Services, LLC.. Timpson Electrical & Aerial Services, LLC. will in no way be liable or responsible for injuries or damages to persons or property, arising from or out of use or operation of the equipment within described. Timpson Electrical & Aerial Services, LLC. reserves the right to make changes in design or to make additions to, or improvements in, its product without imposing any obligations upon itself to install them on its products previously installed. Timpson Electrical & Aerial Services, LLC. may provide assistance in the form of recommendations, engineering or technical information and advice but such information is furnished only as an accommodation and Timpson Electrical & Aerial Services, LLC. shall have no liability for incomplete, faulty or inaccurate advice, recommendations or assistance, negligent or otherwise.



IN ADDITION: Timpson Electrical & Aerial Services, LLC.'s liability under this Warranty shall be limited to the repair or replacement of any defective work or material, F.O.B. Havre de Grace, Maryland, USA. Customer shall be responsible for notifying Timpson Electrical & Aerial Services, LLC., in writing, of any claims against this Warranty. Upon receipt of such a written claim, Timpson Electrical & Aerial Services, LLC., shall advise customer as to the warranty action to be taken. Timpson Electrical & Aerial Services, LLC. shall have the sole right to determine what action, if any, is to be taken. Any unauthorized repairs to Timpson Electrical & Aerial Services, LLC. products or systems may cause this warranty to be declared null and void.

Timpson Electrical & Aerial Services, LLC. shall not be liable for any consequential damages including lost sales and profits, injury to person or property, or any other incidental losses.

There are no warranties or remedies for the breach thereof beyond those previously described.



8. Support

Timpson Electrical & Aerial Services provides technical information within this manual, over the phone, and on-site to assist you in using its products.

At www.timpsonllc.com you can find technical assistance measures such as FAQ's and support numbers.

In addition, we offer multiple support programs for installation and continued use. For more information, contact your local representative or a Timpson Electrical & Aerial Services representative.

a. Installation Supervision and Start-Up & Commissioning

Timpson Electrical & Aerial Services includes in every sale, a minimum of 1-day onsite for Start-Up & Commissioning of your system. Available upon request, are additional days. We can arrive one or more days early to oversee the installation of the system, comment on your training yard set-up, or stay one or more days after start-up for onsite support during your first week of use. Please contact your Timpson sales rep for current pricing.

b. New Product Satisfaction Parts Return/Repair

Timpson Electrical & Aerial Services tests all of its products and systems to help ensure that they are fully operational before they were shipped from our manufacturing facilities. However, if your product is not functioning properly, please contact Timpson directly to discuss parts replacement/repair. Due to the nature of the sensitive electronics, no unit, in part or in whole, may be returned.

c. Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any comments or suggestions on how to improve this document, please contact Timpson customer service.