

Table of Contents

Introduction	1
Installation	1
Electrical Installation	2
Calibration	5
Troubleshooting Guide	8
Specifications	10
Warranty	11

All rights reserved. No part of this work covered by the copyrights hereon may be reproduced or copied in any form or by any means - graphic, electronic, or mechanical, including photocopying, recording, taping, or information and retrieval systems -- without written permission of Data Industrial.

Copyright © 1995
Data Industrial Corporation
11 Industrial Drive
Mattapoisett, Ma. 02739
508-758-6390
FAX: 508-758-4057

Introduction

The Series 600 are Pulse Output Transmitters. They are used with all Data Industrial Flow sensors whenever a pulse signal, proportional to flow, is required.

The Series 600 supply necessary power to the sensor and read pulses from it. The Series 600 accumulate and scale the pulses to a user selectable output signal in gallons. For example, one pulse could equal one gallon, 10 gallons, 100 gallons, or some other appropriate resolution. The output scale is field set from an internal 12 position dip switch.

Both models feature TTL output with the option of either opto-isolated transistor closure or dry contact closure for applications requiring interface with a broad range of data collection and control equipment. Both options feature field adjustable pulse duration (length of time contacts remain closed for pulse output).

Installation

Figures 1 and 2 illustrate the mounting dimensions for the Series 600. The Model 600 is mounted in a NEMA 6 enclosure and the Model 650 is an open-chassis circuit board. The Model 650 should be mounted in an enclosure on spacers that allow a minimum of .15" clearance underneath for component leads. The Model 600 can be mounted to any flat surface. A 3-foot cable (Part No. 07061) is provided as standard with the Model 600 and as an option with the Model 650. The Model 650 comes standard with the appropriate connector kit containing nine pins and the connector shell required to mate to the on-board connector. A label on the cover of the Model 600 identifies each terminal for ease in field wiring. See pages 2 and 3 for wiring information of the Model 650.

**Figure 1
Model 600 Enclosure**

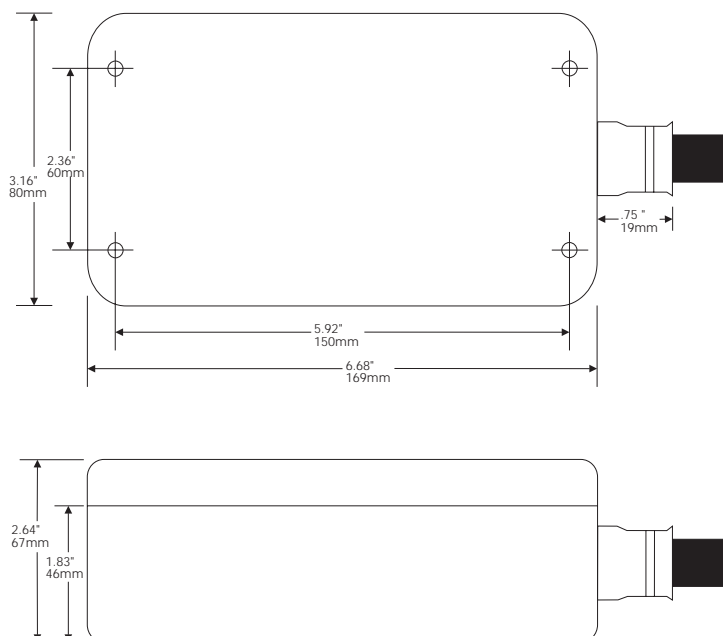
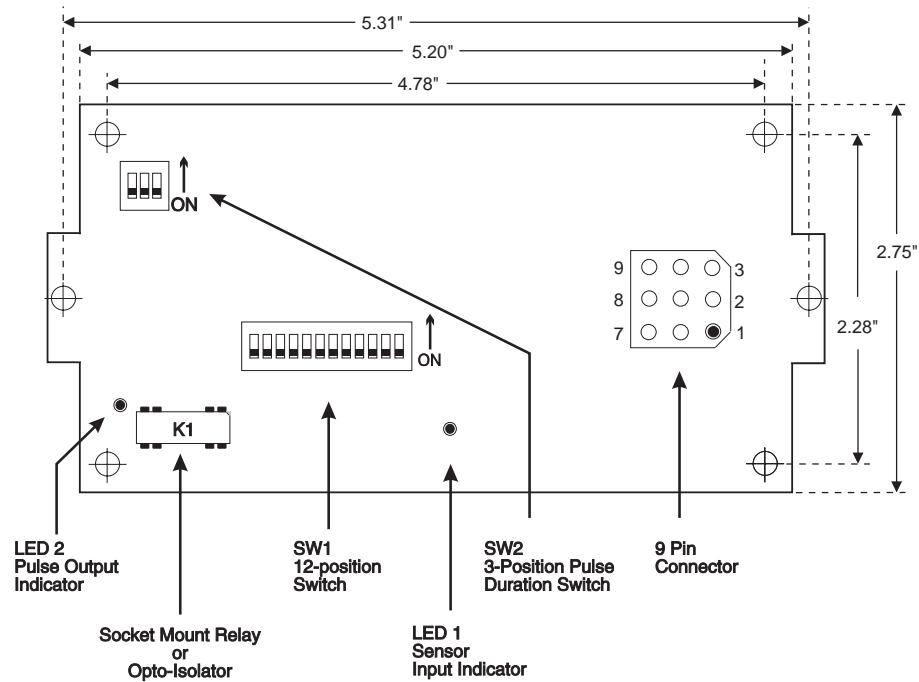


Figure 2
Model 600/650 Printed Circuit Board



Electrical Installation

Power supply for Series 600 should meet the following specifications:

Volts DC = 12 VDC to 40 VDC supply; Max. current draw @ 30 mA

Volts AC = 12 VAC to 30 VAC supply; Max. current draw @ 45 mA

Note: Power supply inputs, Sensor inputs and TTL output are designed to withstand a 5,000 volt, 1/2 microsecond, 100 kHz ring wave.

Table 1 illustrates the appropriate pin numbers for connecting all DIC Sensors and power supply wiring. "2-wire" Sensors are provided with RED, Black (BLK) and Bare (SHIELD) wires. 4000 Series Small pipe sensors (1/2" to 1") are provided with RED, Black (BLK), White (WHT) and Bare wires. It is recommended that the RED Cable Wire of the interface cable be cut at the internal connector when wiring "2-wire" sensors to the Series 600. This will help eliminate incorrectly wiring the sensor leads. Do not cut the red sensor lead.

Table 1

PIN#	COLOR		DESCRIPTION	2-WIRE	3-WIRE
1	RED	SENSOR	POWER	UNUSED	RED
4	YELLOW		SIGNAL	RED (+)	WHITE
2	GREEN		COMMON	BLACK (-)	BLACK
5	BARE		SHIELD	BARE	BARE
6	BLACK	POWER	AC LOAD/DC (+)		
3	WHITE		AC COMMON/DC (-)		

TTL Output Signal Wiring, All 600 and 650 Models

This output is LSTTL compatible with state as normally high. The signal may be pulled to 15 VDC maximum with an external pull-up resistor for CMOS compatibility. Output requires 2-wire connections as shown in Table 2.

Table 2

PIN#	COLOR	DESCRIPTION
2	GREEN	COMMON (Sensor/COM)
7	BLUE	TTL OUTPUT SIGNAL

Dry Contact Relay Output Wiring, Models 600-15 and 650-15

Dry contact relay closure is provided by a reed relay, SPST with contact rating of 10VA @ 0.5 Amps, guaranteed to withstand 275 VDC isolation. Table 3 illustrates appropriate terminal wiring connections.

Table 3

PIN#	COLOR	DESCRIPTION
8	ORANGE	} N.O. RELAY CONTACT
9	BROWN	

Opto-Isolated Output Model Wiring, Models 600-20 and 650-20

Opto-Isolated output utilizes a TIL 117 Device which requires the installer to maintain polarity when interfacing to other equipment. The following specifications apply to the opto-isolated circuits:

- VCE max = 30 VDC (max. volts applied to device)
- VCE sat. = 0.4V @ 0.5 mA (current sink capability)
- Isolation = 275 VAC (differential between ground and device)

Table 4

PIN#	COLOR	DESCRIPTION
8	ORANGE	(+) HIGH VOLTS OUTPUT
9	BROWN	(-) LOW VOLTS OUTPUT

Series 600 Manual

Dual Pulse Output Model wiring, Models 600-16 and 650-16

Dual Pulse Output Model provides 2 separate dry contact relay closures from a single DPST reed relay with contact ratings of 10VA@ 0.5A. Table 5 illustrates appropriate terminal wiring connections.

Table 5

PIN#	COLOR	DESCRIPTION
2	GREEN	} RELAY #1 - N.O CONTACT
7	BLUE	
8	ORANGE	} RELAY #2 - N.O CONTACT
9	BROWN	

Note: The sensor wiring for the Model 600-16/650-16 is different the standard 600 Series. Table 6 illustrates the appropriate wiring connections.

Table 6

PIN#	COLOR	DESCRIPTION
1	RED	POWER (NOT USED WITH 200 SERIES SENSOR)
4	YELLOW	SIGNAL
5	BARE	SENSOR COMMON AND SHIELD

Calibration

Two functions must be set during field calibration of the Series 600: Gallons per Pulse range based on flow sensor and pipe size, and pulse duration based on the equipment to be interfaced.

Each of these field adjustments are accomplished through setting ON/OFF dip switches located on the circuit board. SW1 (a 12-position switch) sets Gallons per Pulse output signals based on pipe size. SW2 (a 3 position switch) sets the length of time the output pulse contacts are closed. See Figure 2 for location. There are two LEDs located on the circuit board. LED1 flashes in conjunction with the actual pulses received from the flow sensor, while LED2 flashes with output pulse signals.

Field Calibration of Output Pulse Signal

To field program the output pulse signal, locate the 12 position dip switch (**SW1**) on the transmitter circuit board. Toggling the dip switches ON or OFF in the correct manner sets the value for the internal circuitry to determine the resolution of the output signal.

The 12 position dip switch, SW1, is set following standard binary number format. Beginning with switch location 1. This first switch is programmed to equal 1 when turned ON. Each adjacent switch is programmed to be a value two times the previous switch when also turned ON.

Switch 1 =	1
Switch 2 =	2
Switch 3 =	4
Switch 4 =	8
Switch 5 =	16
Switch 6 =	32
Switch 7 =	64
Switch 8 =	128
Switch 9 =	256
Switch 10 =	512
Switch 11 =	1024
Switch 12 =	2048

Setting the above switches is an additive process. For example, if you select a pipe size/ flow combination that requires programming the number "416" into the processor, you would turn ON switches 6, 8, and 9. Switch 6 = 32; Switch 8 = 128 and Switch 9 = 256. Adding these three numbers gives a total value of "416" to the divider circuitry. If you select a value of 51, you would turn ON Switches 1, 2, 5 and 6 for a total of 51 (1 = 1; 2 = 2; 5 = 16 and 6 = 32).

Note: The largest binary number that can be programmed with the 12 position switch is 4,095, the total of all switches (1-12) if they are all turned ON. The value, determined by the switch setting of SW1, creates the minimum and maximum range of total gallons/pulse to be scaled. For other settings or numbers, please consult the factory or your local representative.

Table 8 on the page 7 provides the data to set the Series 600 dip switches for Data Industrial sensors in popular pipe sizes. The dip switch setting columns list the switch positions to be turned ON to program the divider circuitry for various pipe sizes. The divider circuitry "divides" the input sensor frequency by an appropriate number to provide either 1 gallon/pulse, 10 gallons/pulse, 100 gallons/pulse or 1,000 gallons/pulse.

Series 600 Manual

For special pulse output settings such as different gallons/pulse figures, cubic meters/pulse, liters/pulse or other pipe sizes or units not listed, please consult the factory or your local representative.

Note: In selecting a value of “gallons/pulse” for calibration purposes, 5 ft./sec. was chosen as being representative of accurate measurement across the entire flow range. The full scale velocity range for Data Industrial equipment is 1 to 30 ft/sec.

The dip switch positions have been calculated for current Data Industrial flow sensors. After locating the correct model number and/or pipe size, follow across to the appropriate column, “DIP SWITCH SETTING.” The values listed here define which dip switches are to be turned ON. Make sure the balance of dip switches are turned OFF. This process will enter the correct “Divide-by” number to transmit the correct Gallons/Pulse.

Note: Data Industrial suggests the listed “Gallons/Pulse” resolutions as the most appropriate value for each pipe size. This is based on our experience in dealing with input pulse frequency of common industrial devices. After making your calibration selections. Check to ensure that the output pulse rate is within the acceptable range of your equipment.

Calibration of Pulse Duration

Pulse duration is the length of time that the relay is closed when sending an output pulse to other equipment. The time duration is adjusted by setting the 3 position switch SW2 located on the PCB as Figure 2 illustrates.

The time variations available from the 3 position switch (SW2) range from 0.1 seconds to 1.5 seconds in increments of 0.2 seconds. There are eight settings available. They are set by turning ON the various combinations of dip switch settings as illustrated in Table 6.

Table 7

Switch 1	Switch 2	Switch 3	Seconds
ON	ON	ON	0.1
OFF	ON	ON	0.3
ON	OFF	ON	0.5
OFF	OFF	ON	0.7
ON	ON	OFF	0.9
OFF	ON	OFF	1.1
ON	OFF	OFF	1.3
OFF	OFF	OFF	1.5

Note: When selecting pulse duration, the unit cannot have a pulse width longer than the maximum output frequency. When the pulse width is too long, the relay will stay “ON” all the time (LED2 always lit). If this occurs, adjust the pulse output duration to a lesser number. If you have any questions consult the factory or your local representative.

Table 8

FLOW SENSOR OR PIPE SIZE	PIPE ID	MIN FLOW IN GPM	DIP SWITCH SETTING FOR 1 GAL/PULSE	DIP SWITCH SETTING FOR 10 GAL/PULSE	DIP SWITCH SETTING FOR 100 GAL/PULSE	DIP SWITCH SETTING FOR 1000 GAL/PULSE
41020 - 1/2 w/jet	0.290	0.25	4,5,8,9	3,5,6,7,8,9,10,11,12	-	-
41120 - 3/4 w/jet	0.480	0.5	3,4,6,8	3,4,5,6,8,10,11	-	-
40020 - 1/2	0.530	1	1,2,4,5,7	5,8,9,10	-	-
40120 - 3/4	0.720	1	1,3,4,5,7	1,2,6,8,9,10	-	-
40220 - 1	0.930	1	2,3,4,5,7	1,3,4,6,8,9,10	-	-
220P-1	1.000	2	1,4,9	1,2,3,5,7,10,12	-	-
220P-1.5	1.500	8	6	7,9	1,3,4,5,6,7,11,12	-
220P-2	1.940	13	2,3,5	1,2,3,5,7,8	1,2,3,6,7,12	-
220P-3	4.020	35	1,2,3	4,7	1,2,4,7,8,10	-
220P-4	5.150	65	3	1,2,3,6	2,8,9	1,2,3,5,9,10,11,12
228B-2	1.990	10	2,3,5	2,4,5,7,8	4,8,12	-
228B-2.5	2.520	16	5	1,3,4,5,8	2,3,6,10,11	-
228C-2-150	2.070	12	1,3,5	2,5,7,8	4,5,6,12	-
228C-2.5	2.510	16	5	2,3,4,5,8	1,2,3,4,6,10,11	-
228SS-2	2.070	12	1,3,5	2,5,7,8	4,5,6,12	-
228SS-2.5	2.510	16	5	2,3,4,5,8	1,2,3,4,6,10,11	-
228C-2-400	2.100	12	1,2,3,5	3,6,7,8	3,6,7,8,12	-
250B-1	1.050	1.5	1,2,3,4,8	3,5,8,9,11	-	-
250B-1.25	1.380	2	2,3,4,7	1,3,4,9,10	-	-
250B-1.5	1.610	3	4,5,6	2,5,6,10	-	-
INSERTION SENSORS						
2.5" SCH40	2.470	15	2,4,5	1,2,3,9	1,2,4,7,10,12	-
3" SCH40	3.068	23	2,3,4	1,4,8	3,4,5,7,9,11	-
3" SCH80	2.900	21	5	1,2,4,5,8	1,5,10,11	-
4" SCH40	4.026	40	1,2,3	1,2,3,7	1,4,7,8,10	-
4" SCH80	3.826	36	4	1,5,7	2,4,6,9,10	-
6" SCH40	6.065	90	1,2	1,2,4,5	1,2,5,9	1,2,4,5,6,8,10,12
6" SCH80	5.761	81	1,2	2,3,4,5	1,5,6,9	2,3,6,7,8,9,10,12
8" SCH40	7.981	156	-	1,2,3,4	3,5,8	1,2,7,8,9,11
8" SCH80	7.625	142	-	5	1,2,6,8	1,3,4,5,7,10,11
10" SCH40	10.020	246	-	1,4	1,2,4,5,7	2,5,8,9,10
10" SCH80	9.564	224	-	2,4	1,3,6,7	1,2,3,4,6,7,8,9,10
12" SCH40	11.938	349	-	2,3	1,3,4,5,6	2,6,7,10
12" SCH80	11.376	317	-	1,2,3	1,3,7	1,3,4,6,8,10
14" SCH40	13.124	422	-	1,3	1,2,5,6	2,4,5,6,7,8,9
14" SCH80	12.500	383	-	2,3	1,2,3,5,6	1,4,6,10
16" SCH40	15.000	551	-	3	1,2,3,6	4,8,9
16" SCH80	14.314	502	-	3	1,2,4,6	2,3,4,6,8,9
18" SCH40	16.876	697	-	1,2	1,2,3,4,5	2,3,5,6,9
18" SCH80	16.126	637	-	1,2	2,6	3,5,7,9
20" SCH40	18.814	867	-	-	1,4,5	4,5,6,7,8
24" SCH40	22.626	1253	-	-	1,5	4,6,8
30" SCH10	29.376	2113	-	-	2,4	6,7

Troubleshooting Guide

This guide is intended to help pinpoint and diagnose any problems encountered when using the Series 600 to signal chemical feed pumps, computer systems, or other equipment.

1. POWER SUPPLY VERIFICATION

The Series 600 can be operated from any power supply 12-30VAC or 12-40VDC. Measure the voltage across Pin 3 (white wire) and Pin 6 (black wire) of the nine pin connector. Voltmeter should read the same as supply voltage being applied.

2. INPUT AND SENSOR OPERATION

The sensor responds to flow velocity by generating a series of pulses, which on an oscilloscope appears similar to contact closure signals. When the input is "High" (sensor disconnected or not generating pulses), LED1 (Sensor Input Indicator) will not be lit. When the input is held "Low," by shorting the input, LED1 will be lit brightly. When pulses are being received from the sensor, LED1 will flash once for each pulse received. At higher flow velocities flashes may be too quick to be distinguished individually, causing LED1 to appear dimly lit.

- a.** With sensor connected (No Flow) measure voltage across Pin 4 (yellow wire) and Pin 2 (green wire). A voltage between 7.0VDC and 8.0VDC should be observed.
- b.** If the voltage measured in step 2a is less than 7.0VDC, check wiring for wet or shorted splices, damaged wires, or breaks in insulation. If wiring appears correct and in good condition, the problem may be internal to the sensor, requiring its replacement or return to the factory for evaluation.
- c.** If the voltage is greater than 8.0VDC check for breaks or bad splices in wiring.
- d.** If the voltage is in the normal range, shorting Pin 4 (yellow wire) to Pin 2 (green wire) on Models 600-15, 600-20; Pin 4 (yellow wire) to Pin 5 (bare wire) on Models 600-16, 650-16 should light LED1, indicating that the unit would recognize pulses from the sensor if they were being received.
- e.** To test the operation of the sensor, remove the sensor from the pipe, and spin the impeller by hand. It should spin freely and glide smoothly to a stop. The rate of LED1 flashes should be directly proportional to impeller RPM (2 flashes per revolution). If the sensor generates normal pulses and spins freely, it can be assumed that something is preventing the impeller from spinning in the flow. (Low flow rate, partially filled pipe, obstruction in line, etc.)

3. TEST DIVIDE BY CIRCUIT

- a. The dip switches SW1 1-12 represent a pulse division by a value between 1 and 4095. If all SW1 switches except SW1-1 are turned OFF, circuit will produce one output pulse for every input pulse received. With SW1-1 and SW1-2 both ON, one output pulse will be generated for every three input pulses. As additional switches are turned on, more counts are required to produce one output pulse. When all the SW1 switches are ON, one output pulse per 4095 input pulses will be produced. Input counts can be simulated by briefly shorting the Pin 4 (yellow wire) and Pin 2 (green wire). Please note: multiple input counts can occur, caused by contact bounce when making connections by hand. For this reason, this test is only practical for divisions by small numbers where the procedure can easily be repeated.
- b. LED2 (Output Indicator) lights each time the number of input pulses represented by the SW1 switches 1 through 12 is reached. The output relay will be closed anytime LED2 is lit, and can be observed by monitoring the continuity across Pin 8 (orange wire) and Pin 9 (brown wire). When closed the resistance should measure less than one ohm. When LED2 is not lit, there should be no continuity between these terminals.

4. OUTPUT PULSE DURATION — SW2 (3 POSITION DIP SWITCH)

- a. The function of this switch is to set the length of time the dry contact remains closed.
- b. With all three (3) of SW2's switches ON, LED2 (output signal indicator) should remain ON for approximately 0.1 second each time a pulse output occurs.
- c. With all three of SW2's switches OFF, LED2 remains ON for about 1 1/2 seconds for each pulse output.
- d. If the relay appears to be closing, but the device it is pulsing fails to recognize the closure, check the input specifications of the receiving device. The pulses may be occurring at too fast a rate, or of insufficient duration to be recognized by the devices input debounce circuitry, or program sequence timing. Our dry contact closure can be simulated, by briefly shorting the wires normally connected to Pin 8 (orange wire) and Pin 9 (brown wire). If the pulse is recognized, the interface wiring is correct.

If you require additional troubleshooting assistance, contact the factory service department at (508) 758-6390. Be prepared with Model and serial numbers, a description of the problem encountered, and a list of steps already taken in an attempt to correct the problem.

Specifications

Model 600

Watertight, housed version with 36" cable

Model 600-15: Dry contact relay output signal and TTL output

Model 600-16: Dual Dry contact relay output signal

Model 600-20: Opto-isolated output signal and TTL output

Model 650

Open chassis circuit board only (no cable)

Model 650-15: Dry contact relay output signal and TTL output

Model 650-16: Dual Dry contact relay output signal

Model 650-20: Opto-isolated output signal and TTL output

Power Requirements

12-30VAC, 45mA maximum or 12-40VDC, 30mA maximum

Reverse overvoltage protected to 40VDC

Transient Suppression

Designed to withstand a 5,000 Volt 1/2 microsecond, 100KHz ring wave

Temperature Range

Operating Temperature -20° to 150°F (-29° to 65°C)

Conformal Coating

Circuit boards are coated with a clear coating meeting Mil-spec Mil-I-46058C, type AR, for humidity, moisture resistance and fungus resistance.

Cable

Eight conductor 22 AWG tinned copper with foil shield .250" diameter, 80°C

Temperature rating, UL/CSA listed.

Enclosure

Polycarbonate with tongue/groove neoprene sealed cover for watertight integrity.

Meets NEMA 1, 2, 3, 3R, 4, 4X, 5, 6, 12 and 13 specifications.

TTL Output

The output is a normally high signal, which goes low for the duration of the output pulse as determined by the Pulse Width DIP switch (SW2). The output is essentially an open collector output with a high resistance pull-up to 5 VDC.

Output Signal Pin	J2 pin 7 (or PAD 3)
Output Common Pin	J2 pin 2 (or PAD 1)
Output High	5 V +/- 10%, with no load Source resistance = 50 Kohms (approximately)
Output Low	0.35 V maximum, sinking 1 mA Sinking resistance = 100 ohms (approximately)

This signal may be pulled up to a higher potential by an external resistor for CMOS or other logic compatibility up to the maximum rated voltage of the output.

Warranty

Data Industrial Corporation ("Seller") of 11 Industrial Drive, Mattapoisett, Massachusetts 02739-0740, U.S.A., warrants to the original purchaser of its product that such product manufactured by Data Industrial Corporation shall be free from defects in materials or workmanship when installed, serviced and operated according to Data Industrial corporation instructions or in other such normal use. This warranty is effective for a period of 12 months from the date of installation by the Purchaser or 18 months from the date of shipment by the "Seller" whichever occurs or terminates first. This limited warranty does not cover damage or loss resulting from corrosion or erosion caused by acids or other chemicals or by severe environmental conditions or negligent or improper installation or improper operation, misuse, accident, unauthorized repair or substitution of components other than those provided by the "Seller", and does not cover limited life components such as bearings, shafts, impellers where wear rate is a function of application and environment. Any component not manufactured by the "Seller" but included in its products shall not be covered by this warranty and is sold only under such warranty as the manufacturer may provide.

If Buyer or Purchaser wishes to make a claim hereunder, he shall send written notice of any defect within the warranty period, to "Seller" at the above address. "Seller" may at its sole option instruct Buyer to ship subject part, postage prepaid, to the "Seller" at above address or authorize a representative to inspect the part on site. "Seller" will at its sole option repair or replace any defective product covered by this warranty. If Buyer makes repairs or alterations to any product or part covered by this warranty without "Sellers" prior written approval, this warranty shall be null and void.

The foregoing shall constitute Buyers or Purchasers sole and exclusive remedy against "Seller", and no other remedy, including but not limited to, incidental or consequential damages for personal injury, loss of fluids, gases or other substances or for loss of profits or injury to property or person shall be available to the Buyer or Purchaser. The warranty extended herein shall be in lieu of any other implied warranty of merchantability or fitness for a particular purpose, and seller shall bear no liability for representatives or retail sellers. In no event shall Data Industrial Corporation be liable for any contingent, incidental, or consequential damage or expenses due to partial or complete inoperability of its product.