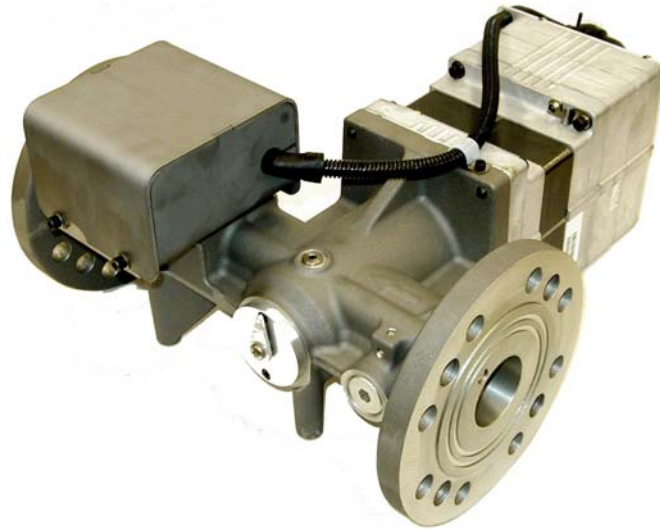# WOODWARD

Installation and Operation Manual

TecJet™ 50 Plus / TecJet 50 Plus Precision Flow Gas Regulation and Metering Valve/Actuator System

Manual 26219 (Revision G)

IMPORTANT

DEFINITIONS

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER**—Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING**—Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**—Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE**—Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT**—Designates an operating tip or maintenance suggestion.

WARNING

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, be sure to check the Woodward website:
www.woodward.com/pubs/current.pdf
The revision level is shown at the bottom of the front cover after the publication number. The latest version of most publications is available at:
www.woodward.com/publications
If your publication is not there, please contact your customer service representative to get the latest copy.

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

NOTICE

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

NOTICE

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Revisions—Text changes are indicated by a black line alongside the text.

Contents

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Illustrations and Tables

Regulatory Compliance

European Compliance for CE Marking

EMC Directive: Declared to 89/336/EEC COUNCIL DIRECTIVE of 03 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.

Other European Compliance
Compliance with the following European Directives or Standards does not qualify this product for application of the CE marking:

Machinery Directive: Compliance as a component with 98/37/EC COUNCIL DIRECTIVE of 23 July 1998 on the approximation of the laws of the Member States relating to machinery.

Pressure Equipment Directive: Exempt per Clause 4 of the Pressure Equipment Directive 97/23/EC of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment.

North American Compliance

CSA: CSA Certified for Class I, Division 2, Groups A, B, C, D, T3 at 85 °C ambient for use in Canada and the United States
Certificate 1167451

This product is certified as a component for use in other equipment. The final combination is subject to acceptance by CSA International or local inspection.

The TecJet™ is suitable for use in Class I, Division 2, Groups A, B, C, and D per CSA for Canada and US, or non-hazardous location only.

The TecJet wiring must be in accordance with North American Class I, Division 2, or Zone 2 wiring methods as applicable, and in accordance with the authority having jurisdiction.

Wiring for the TecJet power input must be suitable for at least 85 °C.

Connect ground lug of TecJet to earth ground.

⚠WARNING	**EXPLOSION HAZARD—Do not remove covers or connect/disconnect electrical connectors unless power has been switched off or the area is known to be non-hazardous.**
	Substitution of components may impair suitability for Class I, Division 2 or Zone 2.

⚠AVERTISSEMENT	**RISQUE D'EXPLOSION—Ne pas enlever les couvercles, ni raccorder / débrancher les prises électriques, sans vous en assurez auparavant que le système a bien été mis hors tension; ou que vous vous situez bien dans une zone non explosive.**
	La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2 ou Zone 2.

> **⚠ WARNING**   Due to the hazardous location listing associated with this product, proper wire type and wiring practices are critical to operation.

> **NOTICE**   Do not connect any cable grounds to "instrument ground", "control ground", or any non-earth ground system. Make all required electrical connections based on the wiring diagram per Figure 2-2.

Electrostatic Discharge Awareness

All electronic equipment is static-sensitive, some components more than others. To protect these components from static damage, you must take special precautions to minimize or eliminate electrostatic discharges.

Follow these precautions when working with or near the control.

1. Before doing maintenance on the electronic control, discharge the static electricity on your body to ground by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.).

2. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.

3. Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cup holders, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, and plastic ash trays) away from the control, the modules, and the work area as much as possible.

4. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:

    *   Do not touch any part of the PCB except the edges.

    *   Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.

    *   When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

> **NOTICE**   To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Chapter 1.
General Information

Introduction

The TecJet™ valve/actuator is an integrated, digitally compensated control valve and actuator system for regulating and metering the flow of gaseous fuels. The device is designed to accept a fuel rate demand signal. It also incorporates feedback sensors that monitor fuel pressure, temperature, and valve pressure differential. Based on these sensor signals, the device modulates the valve opening to produce a physical fuel mass flow that matches the flow demand level within the accuracy specified elsewhere in this manual.

This manual covers the TecJet 50 Plus (TJ50P) and the TecJet 50 Plus Precision Flow (TJ50PPF) Fuel Metering Valves.

The TecJet valve/actuator is intended to be mounted on or very close to the engine. The dominant application of this valve is gas fueled reciprocating engines controlled by an electronic engine control system.

IMPORTANT	**Throughout the remainder of the manual, the TecJet valve and actuator system will be referred to simply as the TecJet.**

Connections to the TecJet

The TecJet valve has the following connections to the ECM (Engine Control Module), and the engine harness:

Earth Ground	Provided through ground lug on housing.
Power Input	18–32 Vdc measured at the TecJet.
Key Switch input	Contact input to switch the TecJet in and out of a low-power state.
CANbus In	Configurable as mass flow demand input.
PWM	Configurable as mass flow demand input.
4–20 mA Analog	Configurable as mass flow demand input.
CAN ID Inputs	TecJet number selection for CANbus IDs.
CAN Termination	Internal CAN termination resistor option.
CANbus Out	Second set of CAN pins for connecting to the next CAN device.
Status Output	High side switch that changes state during a fault condition.

The TecJet has available RS-232 connections in the main connector for program upgrades and service tool interfacing by qualified service personnel.

Chapter 2.
Installation

Introduction

⚠ **WARNING**	The TecJet valve is pressure tested at Woodward. Allowable external leakage is less than 2 sccm or 0.00015 kg/h.

⚠ **WARNING**	The TecJet valve is NOT equipped with an overboard drain in the event of gas leakage through its various seals. The valve should therefore be used in a well ventilated area. A methane detector should be used if the valve will be used in an enclosed installation.

⚠ **CAUTION**	The TecJet™ weighs 24 kg (52 lb). In order to prevent injury, some form of lifting assistance (a lifting strap is recommended) should be used when handling the TecJet.

Be careful when unpacking the TecJet. Check the assembly for signs of damage, such as bent or dented covers, scratches, and loose or broken parts. Be especially careful not to rest the TecJet on the valve position pointer or the actuator electrical connectors. Notify the shipper and Woodward if damage is found.

If the TecJet is to be painted, appropriate means must be used to mask the following items/areas:

- All identification and warning labels
- Main electrical connector
- Junction between the valve shaft and the valve housing (this is a dynamic junction next to the valve position pointer)

Mounting

TecJet orientation and mounting must be designed to reduce the possibility of fuel contamination. Orientation of the valve should be with the actuator ±15° relative to horizontal with the sensor module skyward. The axis of the valve bore can be +90/–15° relative to horizontal, with +90° representing the outlet of the valve pointing skyward. Installations with a bore axis orientation in the +15 to +90° range must incorporate means to prevent the buildup of moisture or other liquids in the fuel train. The valve has an arrow indicating flow direction cast into the outside of the valve housing. Washers should be placed between the valve body and any fasteners used. Give consideration to the strength of the mounting plate in order to support the 24 kg (52 lb) weight of the TecJet. Refer to the outline drawing in Figure 2-2 for dimensions and details relative to the valve inlet flange and outlet flange.

For on-engine applications, a suitable bracket must be constructed to brace the actuator to a secure structure on the engine. See the outline drawing (Figure 2-1) for the actuator mounting hole and hole-location details. This actuator mounting configuration should ensure that moment loads are not applied to the actuator, either through installation or thermal stress that could cause the valve to bind and lose functionality.

The inlet and outlet piping of the TecJet must be in accordance with ANSI/ISA-S75.02 to ensure the flow metering accuracy specified elsewhere in this manual. However, an inlet piping length as short as 6 diameters and an outlet piping length as short as 2 diameters can typically be used with a negligible loss in valve metering accuracy.

⚠️**WARNING**	**Leak check all gaseous fuel connections. Leaking gaseous fuel can cause explosion hazards, property damage, or loss of life.**

Electrical Connections

The TecJet is electrically connected to the control system (ECM) by the main connector (Figure 2-2). The engine harness mating connector for the TecJet is MS3106E24-28S. This mating connector should be torqued per the value indicated in Figure 2-1.

⚠️**WARNING**	**EXPLOSION HAZARD—Do not remove covers or connect/disconnect electrical connectors unless power has been switched off or the area is known to be non-hazardous.**

⚠️**AVERTISSEMENT**	**RISQUE D'EXPLOSION—Ne pas enlever les couvercles, ni raccorder / débrancher les prises électriques, sans vous en assurez auparavant que le système a bien été mis hors tension; ou que vous vous situez bien dans une zone non explosive.**

⚠️**WARNING**	**Due to the hazardous location listing associated with this product, proper wire type and wiring practices are critical to operation.**

NOTICE	**Do not connect any cable grounds to "instrument ground", "control ground", or any non-earth ground system. Make all required electrical connections based on the wiring diagram in Figure 2-2.**

OUTLET FLANGE:
 BOLT PATTERN WILL ACCOMMODATE BOTH:
  - DIN 2501, DN 80, PN 10/16
  - ANSI B16.5, NOM 3 INCH PIPE, CLASS 150

.7187
8X Ø.6987 THRU FLANGE
18.25
17.75

⌖ | Ø.033 Ⓜ | A | B Ⓢ |
⌖ | Ø.020 Ⓜ | A |
-C-

SEE DETAIL A FOR BASIC LOCATIONS

(13.212)
335.57

(12.820)
325.63

2.146
54.50

2.265
57.53

5.803
147.4

(Ø2.065)
52.45
-B-

(3.250)
82.55

4.530
115.06

5.700 MAX
144.8

.760
4X Ø.740 THRU FLANGE
19.3
18.8

⌖ | Ø.033 Ⓜ | A | B Ⓢ |
⌖ | Ø.020 Ⓜ | A |

SEE DETAIL A FOR BASIC LOCATIONS

(Ø7.874)
200

4X M8 X 1.25
.625/15.8 MIN DEEP

⌖ | Ø.190 Ⓜ | A | B Ⓢ | C Ⓢ |
⌖ | Ø.120 Ⓜ | E |

1.000 MAX
25.4

⚠ 1

(.850)
21.6

-A-

(2.730)
69.35

(7.820)
198.64

(9.788)
248.62

15.566
15.536
395.38
394.62

(.850)
21.6

-D-

VALVE POSITION
INDICATOR

.760
4X Ø.740 THRU FLANGE
19.3
18.8

⌖ | Ø.070 Ⓜ | A | B Ⓢ | C Ⓢ |
⌖ | Ø.025 Ⓜ | D |

SEE DETAIL A FOR BASIC LOCATIONS

4.890 MAX
124.21

16.135 MAX
409.8

7.106
6.906
180.49
175.41

TO ACTUATOR
MOUNTING SURFACE
-E-

⚠

5.800 MIN
147.3

12.900 MAX
327.7

3.400 MAX
86.4

NOTE:
 VALVE MAY ALSO BE MOUNTED IN THIS POSITION
 WITH FLOW FROM BOTTOM TO TOP.

.7187
8X Ø.6987 THRU FLANGE
18.25
17.75

⌖ | Ø.070 Ⓜ | A | B Ⓢ | C Ⓢ |
⌖ | Ø.025 Ⓜ | D |

SEE DETAIL A FOR BASIC LOCATIONS

(Ø2.065)
52.45

(Ø7.874)
200

THE PREFERRED MOUNTING ORIENTATION IS AS SHOWN IN THIS VIEW.
SEE INSTALLATION MANUAL B26219 FOR DETAILED MOUNTING INSTRUCTIONS,
ORIENTATION, AND PIPING REQUIREMENTS.

033-007A_LEFT
04-3-15

INLET FLANGE:
 BOLT PATTERN WILL ACCOMMODATE BOTH:
  - DIN 2501, DN 80, PN 10/16
  - ANSI B16.5, NOM 3 INCH PIPE, CLASS 150

Figure 2-1a. TecJet 50 Plus Outline Drawing
(TecJet 50 Plus Precision Flow is externally the same.)

3.002
2.982 4 PLACES
76.25
75.75

9.769
9.269
248.13
235.43

MATING CONNECTOR:
MS 3106 E 24-28S
TORQUE TO 105 LB IN/12 Nm

.712
.212
18.1
5.4

45° 4 PLACES

(R.375 4 PLACES)
9.53

4X M8 X 1.25
.630/16 MIN
⊕ ∅.020 Ⓜ Ⓑ Ⓜ DE

4.252
108

2.126
54

5.906
150

45° 4 PLACES

4.823
122.5

2.9099
73.91

2.9099
73.91

2.1213
53.88

2.1213
53.88

1.2053
30.61

1.2053
30.61

1.2053
30.61

1.2053
30.61

2.1213
53.88

2.9099
73.91

2.1213
53.88

2.9099
73.91

1.2053
30.61

DETAIL A

⚠1 FOR ON-ENGINE APPLICATIONS,
BRACKET MUST SUPPORT ACTUATOR

Ⓐ
⚠2 THE FOUR MOUNTING LEGS SHOWN MUST
BE PRESENT ON ALL 8407-517 VALVES.
THEY ARE OPTIONAL ON ALL OTHER
TECJET 50 PLUS VALVES.

DIMENSIONING FORMAT: INCH
                      METRIC

GEOMETRIC DIMENSIONING AND
TOLERANCING IS IN INCH

TOTAL WEIGHT APPROXIMATELY 52 LB/25 KG
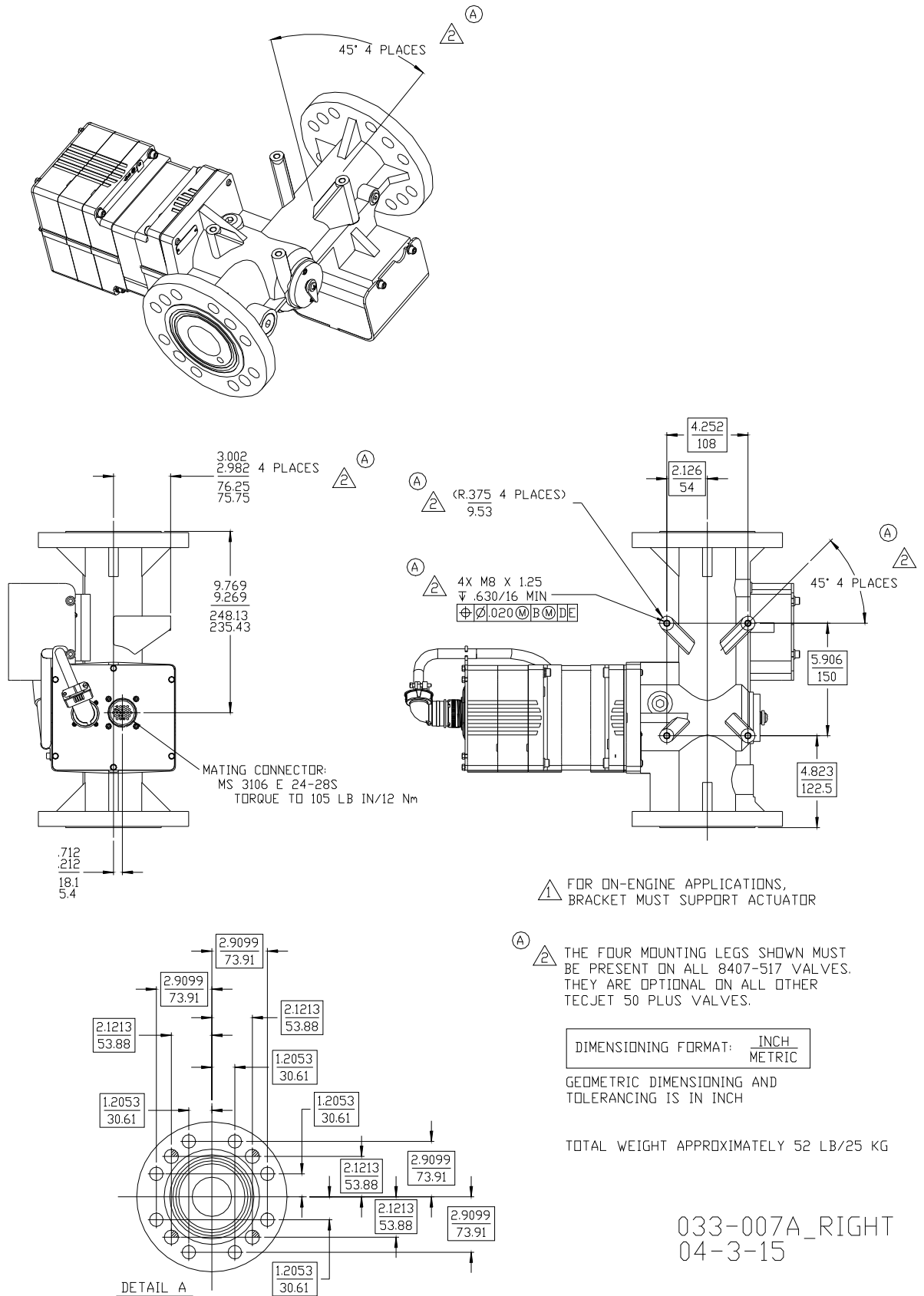
033-007A_RIGHT
04-3-15

Figure 2-1b. TecJet 50 Plus Outline Drawing
(TecJet 50 Plus Precision Flow is externally the same.)

Shielded Wiring

All shielded cable must be twisted conductor pairs. Do not attempt to tin (solder) the braided shield. All signal lines should be shielded to prevent picking up stray signals from adjacent equipment. Connect the shields to the correct pins on the driver connector or wiring as specified in the wiring diagram. Do not connect shields to the actuator ground. Wire exposed beyond the shield should be as short as possible, not exceeding 50 mm (2 inches). The other end of the shields must be left open and insulated from any other conductor. DO NOT run shielded signal wires along with other wires carrying large currents. Where shielded cable is required, cut the cable to the desired length and prepare the cable as instructed below:

- Strip the outer insulation from BOTH ENDS, exposing the braided or spiral wrapped shield. DO NOT CUT THE SHIELD.
- Using a sharp, pointed tool, carefully spread the strands of the shield.
- Pull the inner conductor(s) out of the shield. If the shield is the braided type, twist it to prevent fraying.
- Remove 6 mm (1/4 inch) of insulation from the inner conductors. The shield must be considered as a separate circuit when wiring the system. The shield must be carried through connectors without interruption.

Installations with severe electromagnetic interference (EMI) may require additional shielding precautions. Contact Woodward for more information.

Failure to provide shielding can produce future conditions which are difficult to diagnose. Proper shielding at the time of installation is required to ensure satisfactory operation of the TecJet Gas Metering System.

Earth Ground

Ground Lug = Earth Ground

In order to ensure CE compliance, the connection to the earth ground needs to meet the following requirements. First, the connection must be less than 183 cm (6 ft) in length. Second, the wire that is used must be at least 3.3 mm² (12 AWG) in size.

Supply Voltage

W = Power-In (+)
Z = Power-In (–)

The supply voltage during normal operation must be 18 to 32 V, measured at the TecJet connector. Steady state input current can reach 2.0 A, and transient input current may reach up to 5.0 A. The recommended power supply cable size is at least 1.3 mm² or 16 AWG. The power supply wiring must be fused outside of the valve. The recommended fuse is a 6 A fast blow fuse.

Recommended maximum wire length from power source to TecJet based on an 18 V Power Supply: **16 AWG (1.3 mm²)—12 m (39 ft*)**

*Rated transient torque may not be achievable with an 18 V power supply. Listed lengths will provide at least 75% of rated transient torque.

Recommended maximum wire length from power source to TecJet based on a 24 V Power Supply: **16 AWG (1.3 mm²)—51 m (167 ft)**
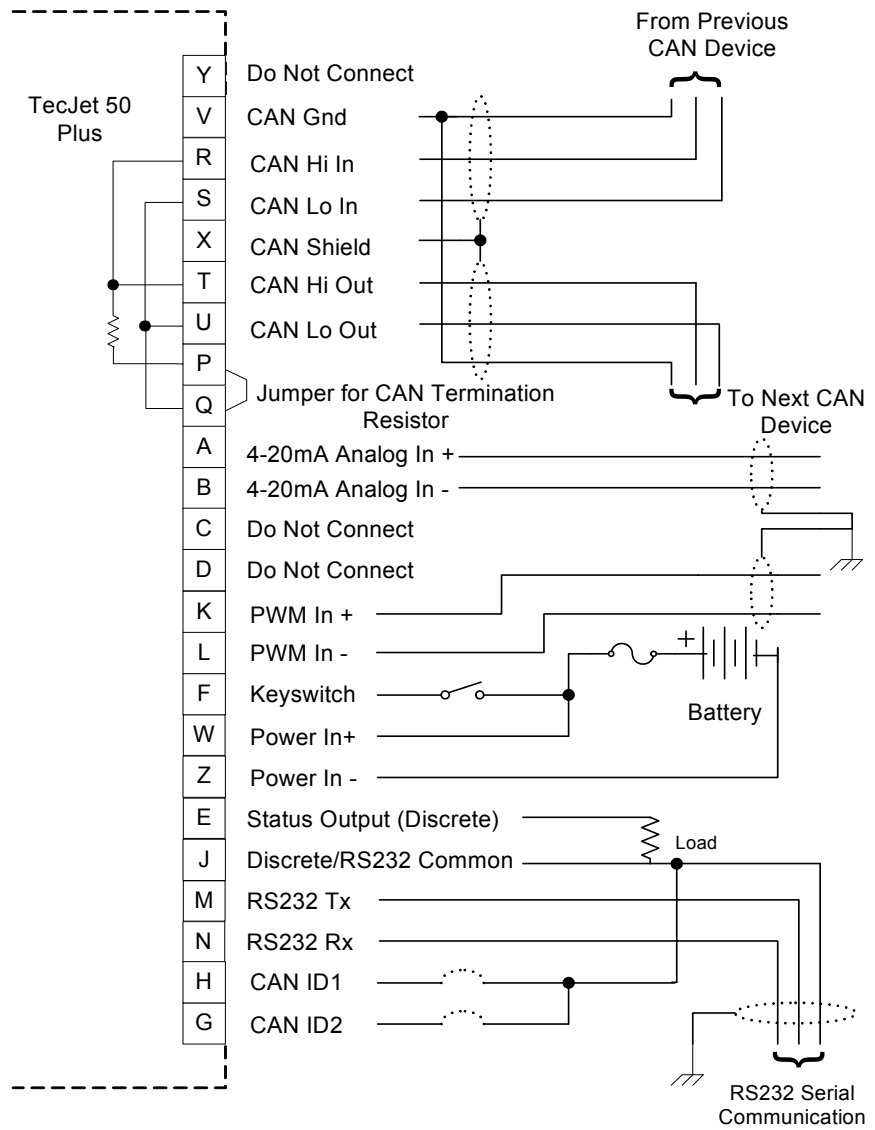
The recommended wire size for W and Z (Power Supply Inputs) is
at least 16AWG. For all other I/O the recommended wire size is
at least 20AWG.

Figure 2-2. TecJet Wiring Diagram

Keyswitch

F = Keyswitch

The keyswitch is not active in all TecJet configurations. The keyswitch is used to switch the TecJet in and out of a low power state (less than 200 mA input current). A high signal (connected to supply [+]) will allow the valve to operate in a normal mode, and a low signal (connected to supply [–] or open connection) will force the valve to a minimum position (if possible) and then into a low power state. When the key switch input goes low, the valve will disable the driver circuitry after the software has gone through a shutdown procedure.

PWM Input

K = PWM input (+)
L = PWM input (–)

The PWM input is configurable as the mass flow demand input. The PWM Input is designed to be used with a push-pull type driver.

Input Magnitude:	7–32 V differential input
Input Impedance:	40 kΩ
Input Type:	Single-ended, ground referenced
Frequency Range:	80–1100 Hz
Isolation:	none
Resolution:	12 bits
Accuracy:	1.5% of full scale @ 25 °C
Temperature Drift:	300ppm/°C
Input Common Mode Range:	At least ±50 V
Safe Input Common Mode Voltage:	At least ±50 V

CAN ID Inputs

H = CAN ID 1
G = CAN ID 2
J = Discrete/RS232 Common

The CAN ID inputs are used to select which CAN identifiers will be used on the CANbus. With no programming tools, the customer can select from the four pre-programmed CAN IDs through a hard-wired code in the engine harness. This is especially important where more than one TecJet is used on an engine. If one TecJet valve is replaced with another, the new valve will read the correct ID number from the engine harness connector. See the table below for the code definition.

TecJet CAN ID	CAN ID1	CAN ID2
"TecJet 1"	Battery + or Open	Battery + or Open
"TecJet 2"	Discrete Common	Battery + or Open
"TecJet 3"	Battery + or Open	Discrete Common
"TecJet 4"	Discrete Common	Discrete Common

CAN Termination

P = Termination resistor
Q = Termination resistor

The internal termination resistor (120 Ω) is used to terminate the CANbus. According to the CAN specification, every CANbus must be terminated at both ends of the bus. If a TecJet valve is connected to the far end of the bus, this termination resistor can be used. If termination is needed, connect a link between pins P and Q. This link should be as short as possible. If no termination resistor is needed, leave pins P and Q unconnected.

⚠ **WARNING**	**If the internal termination is used, other devices on the CANbus may not operate properly when the TecJet valve is disconnected from the bus. An external termination resistor should be used if there are other devices on the CANbus that must not lose communication when the TecJet valve is disconnected.**

CAN In

R = CAN high in
S = CAN low in
V = CAN GND

Pins R, S, and V are the CAN communication wires. Make sure that the correct cable is used for connection to the CAN terminals (SAE J1939/11).

Voltage Level:	5 V
Isolation:	1000 Vrms (optically decoupled)
Type:	The TecJet supports CAN 2.0B
Baud Rate:	Configurable from 250 K to 1 Meg

CAN Out

T = CAN high out
U = CAN low out
V = CAN GND

The CAN output pins are internally connected to the CAN input pins. They are provided for linking more then one TecJet to the CANbus without the need for junction boxes or doubled terminations to connector pins. For example, the CANbus from the control may be connected to the input pins, and the output pins are connected to the second TecJet input pins.

⚠ **WARNING**	**If a second device is connected to the CAN output pins, this device will lose communication if the TecJet valve is disconnected.**

CAN Shield

X = CAN Shield

The CAN Shield can be used to terminate the shield of the CAN wiring. Internally, this pin is connected to the TecJet case through a capacitor.

4–20 mA Analog Input

A = 4–20 mA Analog Input (+)
B = 4–20 mA Analog Input (–)

The 4–20 mA Analog Input is configurable as the mass flow demand input like the PWM input.

Input Impedance:	225 Ω
Input Type:	4–20 mA differential
Max Input Current:	25 mA ±2%
Input Common Mode Range:	At least ±50 V
Common Mode Rejection Ratio:	-60 dB minimum
Safe Input Common Mode Voltage:	At least ±200 V
Accuracy:	±1.5% of full scale @ 25 °C
Temperature Drift:	300ppm/°C

Status Output

E = Status Output
J = Discrete/RS-232 Common

The status output indicates whether the TecJet valve is operating correctly. It will be "on" when the valve is operating normally and "off" when any warnings or errors are active. The Status Output is a high-side switch: it will be actively driven to Battery (+) when "on" and pulled to Battery (–) through a resistor when "off".

Output Type:	High Side Discrete Output Driver
Drive Current:	500 mA max (w/ 24 V supply and 48 Ω load)
Load Range:	48 Ω to 100 kΩ

RS-232 Serial Communication Service Port

M = RS-232 TX
N = RS-232 RX
J = Discrete/RS-232 Common

The access to the service port will be provided through the main connector. The RS-232 communications will be provided for the purposes of configuring and servicing the TecJet.

Isolation:	None
Baud Rate:	38.4 Kbaud

Chapter 3.
Description of Operation

!WARNING	External fire protection is not provided in the scope of this product. It is the responsibility of the user to satisfy any applicable requirements for their system.

⚠CAUTION	Due to typical noise levels in engine environments, hearing protection should be worn when working on or around the TecJet™ valve/actuator.

⚠CAUTION	The surface of this product can become hot enough or cold enough to be a hazard. Use protective gear for product handling in these circumstances. Temperature ratings are included in the specification section of this manual.

Configuration

The valve can be configured to accept a flow demand from the analog input, the PWM input, or the CAN port. The configuration also includes user adjustable warning limits, and default values for failed sensor backup modes. The configuration can be viewed or changed using the TecJet Service Tool. See Chapter 6 for information on installing the service tool.

Power-on Procedure

When power is applied to the valve, it performs a diagnostic check. If there are no problems detected, the actuator is enabled with 0.56 N·m (0.41 lb-ft) of torque, and the valve closes. If the flow demand source is configured for EGS CAN or Jenbacher CAN, the valve reads the CAN ID input pins and begins sending diagnostic information on the CAN link. If a problem is detected, the valve will not operate and the status output will indicate a fault.

The TecJet is typically continuously connected to the supply voltage. If the flow demand source is configured to Jenbacher CAN, the key switch has no effect. If the flow demand source is configured for anything else, the key switch input must be connected to a high signal (supply [+]) for the valve to operate. When the key switch is off, the valve closes, if possible, and the actuator that positions the valve is disabled to minimize the amount of current drawn from the battery.

Normal Operation

If a valid flow demand is present, the valve begins normal operation. The TecJet calculates the area needed to provide the requested flow. This area is calculated using the delta pressure (inlet to outlet pressure differential), the absolute inlet fuel gas pressure, the fuel gas temperature, the fuel gas ratio of specific heats (K), the fuel gas density, and the calibration information stored in the valve. The actuator positions the valve to achieve the calculated area requirement.

Diagnostics

⚠️ **WARNING**	**The TecJet may not return to minimum fuel for all faults. The engine, turbine, or other type of prime mover should be equipped with an overspeed, misfire, detonation detection shutdown device(s), that operate totally independently of the prime mover control device(s) to protect against runaway or damage to the engine, turbine, or other type of prime mover with possible personal injury or loss of life should the TecJet system fail. An independent fuel shutoff device should also be used to shut off fuel flow in case the TecJet system fails.**

The valve continuously performs a variety of diagnostic checks. Diagnostic events are classified as warnings, errors or status indications. The status output indicates the overall status of the valve. For more detailed information and a complete list of the diagnostics, see the User Guide in the TecJet Service Tool. A brief summary follows:

Warnings:
A warning indicates a condition that may require an operator's attention or intervention. For example, the valve may be operating in conditions that are outside its specification range, or a failure has occurred for which there is a back-up mode of operation, possibly with reduced accuracy or performance. If any warnings are active, the status output is "off".

Errors:
An error indicates a problem that prevents the valve from operating. The valve closes, if possible, and remains inoperable until power is cycled. If the error persists, the valve requires service. If any errors are active, the status output is "off".

Status indications:
The valve provides the following status indications:
- **Zero flow detected**—The flow demand is not present or is not valid. The valve is closed and the status output is "off".
- **Zero pressure detected**—The pressure across the valve is essentially zero, so no flow can occur. The valve is closed and the status output is "off".
- **Flow not reached**—The valve cannot achieve the demanded flow given the present operating conditions (fuel gas temperature and pressure, delta pressure, gas K and density). The status output is "off".
- **Overall status OK**—There are no errors or warnings, and the Flow not detected, Zero flow detected, and Flow not reached status indications are not true. The status output is "on".

See Chapter 5 (Troubleshooting) for more information on non-normal operation.

Run Hours Counter

The valve maintains a running hours counter that can be viewed or reset with the service tool. Running hours do not accumulate when the "Flow not detected" status indication is true.

Position Limiter

After the TecJet is powered up and receives a flow command, the valve remains in a closed position until the delta-p sensor senses a non-zero valve delta-p. This non-zero delta-p is established when the fuel source is turned on. Once the non-zero valve delta-p is sensed, the valve is positioned according to an interpolated value from the position limiter table. This table contains three position vs flow command points. By limiting the valve position as the fuel pressure is established, the delta-p required for the TecJet to begin metering fuel is obtained at a lower fuel flow rate. This function ensures that adequate delta-p will be created, even with a substantially drooping fuel source, to allow the TecJet to begin metering fuel.

Here is an example. During start-up, if the valve is operating under very low differential pressure, and the valve indicates a "flow not reached" condition, but the valve position is less than 1.2 radians, then the valve position is being limited by the table values as indicated above. This situation can generally be resolved by increasing the differential pressure across the valve by increasing the valve pre-pressure.

IMPORTANT	After any pressure adjustments, ensure during normal operation that pre-pressure and differential pressure are operating within the ranges specified in the General Specifications section of this manual.

CANopen Communications

The TecJet 110, 50 Plus, and Precision Flow devices support CAN communications in the CIA CANopen Protocol format complying with DS301 version 4.02. Further detailed information regarding CANopen can be obtained at **www.can**-**cia**.**org**. Information about CAN is available at **www.semiconductors.bosch.de**. Specific information regarding TecJet behavior is detailed below.

All TecJet CANopen messages use the CAN 2.0 11-bit Standard Data Frame Format.

Baud Rate
The baud rate is tunable for 125,250,500,1000kbps. The default is 250 kbps.

Node ID
The Node ID is tunable between 1 and 31. The default is 18.

Heartbeat Production Rate
The Heartbeat rate is tunable but defaulted to 1 second.

CANopen State
The TecJet starts in boot-up mode, sends the required Boot Message, and then goes to the pre-operational state. If configured for PWM demand, it will operate based on the PWM signal regardless of the CANopen State (the valve is fully operational.) Once it receives the operational command on the CANbus, the PDOs will be available on the CANbus.

If CAN demand is configured, it needs to receive a command to go to the operational state followed by receiving a valid flow rate on the CANbus before the valve can be operational.

TecJet PDO Support

IMPORTANT	**All data in CANopen is formatted as "Little Endian" also known as "Intel Format".**

This section lists the PDOs that will be sent from the TecJet.

The TecJet will use the standard connection set to assign PDO numbers. The Node ID determines the COB ID for the PDOs.

Transmit PDO table.

Name	NODE_ID	TxPDO	COB_ID	Type	Rate
Fuel Valve Parameters	18	1	402 (192h)	ASYNC	99ms
Gaseous Fuel Flow	18	2	658 (292h)	ASYNC	99ms
Diagnostics & Status	18	3	914 (392h)	ASYNC	198ms

Receive PDOs Table.

Name	NODE_ID	RxPDO	COB_ID	Timeout
Gaseous Fuel Command	18	1	530 (212h)	N/A for PWM. Adjustable for CAN.

Transmit PDO 1 - Fuel Valve Parameters
Transmission rate: 99ms
Message type = "ASYNC" (does not require SYNC message)
COB Id: 402 (0x192) default for Node Id = 18. All others 384+Node Id.
Node ID = 18 (default address of TecJet when configured as TecJet #1)

Data:
Byte 1: Actual Fuel Valve Position
    Data length: 1 byte
    Resolution: 0.4%/bit, 0 offset
    (Multiply received value by 0.4 to recover % value)
    Range: 0 to 100% (0x00 to 0xFA)
Byte 2: Desired Fuel Valve Position
    Data length: 1 byte
    Resolution: 0.4%/bit, 0 offset
    (Multiply received value by 0.4 to recover % value)
    Range: 0 to 100% (0x00 to 0xFA)
Bytes 3-4: Absolute Inlet Gas Pressure
    Data length: 16 bits, integer
    Resolution: 0.1 kPa/bit, 0 offset
    (Multiply received value by 0.1 to recover kPa value)
    Range: 0 to 6425.5 kPa
Bytes 5, 6: Absolute Outlet to Inlet Gas Pressure Differential
    Data length: 16 bits, integer
    Resolution: 0.1 kPa/bit, 0 offset
    (Multiply received value by 0.1 to recover kPa value)
    Range: 0 to 6425.5 kPa
Byte 7: Fuel Temperature
    Data length: 1 byte
    Resolution: 1 °C/bit gain, -40 °C offset
    (Subtract 40 from received value to recover °C value)
    Range: -40 to +210 °C
Byte 8: Reserved, sent as 0.

Transmit PDO 2 - Gaseous Fuel Flow
Transmission rate: 99ms
Message type = "ASYNC" (does not require SYNC message)
COB Id: 658 (0x292) default for Node Id = 18. All others 640+Node Id.

Data:
Bytes 1-4: Fuel Flow – Desired
(Either the demand via PWM or CANopen)

Data length:	4 bytes
Resolution:	0.0002778 L/S/bit, 0 offset
(Divide by 3600 to recover L/S value)	
Range:	0 to 1169744.78194 L/S

Bytes 5-8: Gaseous Fuel Flow – Calculated, based on measured parameters

Data length:	4 bytes
Resolution:	0.0002778 L/S/bit, 0 offset
(Divide by 3600 to recover L/S value)	
Range:	0 to 1169744.78194 L/S

Transmit PDO 3 - Diagnostics and Status
Transmission rate: 198ms
Message type = "ASYNC" (does not require SYNC message)
COB Id: 914 (0x392) default for Node Id = 18. All others 896+Node Id.

Range: Boolean, 8 bytes of status. All reserved bits are set to 0.
Data Length: 8 bytes

Byte 1 (Overall Status)
Bit 0: OVERALL_STATUS_OK
Bit 1: HOLD_POSITION_WARN
Bit 2: ZERO_PRESSURE_DETECTED
Bit 3: ZERO_FLOW_DETECTED
Bit 4: FLOW_NOT_REACHED
Bit 5: VALVE_POSITION_ERROR
Bit 6: HIGH_ELEC_TEMP
Bit 7: RESERVED

Byte 2
Bit 0: ELEC_TEMP_FAIL_HIGH
Bit 1: FGT_FAIL_HIGH
Bit 2: DELTA_P_FAIL_HIGH
Bit 3: FGP_FAIL_HIGH
Bit 4: COIL_CURRENT_FAIL_HIGH
Bit 5: RESERVED
Bit 6: RESERVED
Bit 7: POSITION_FAIL_HIGH

Byte 3
Bit 0: ELEC_TEMP_FAIL_LOW
Bit 1: FGT_FAIL_LOW
Bit 2: DELTA_P_FAIL_LOW
Bit 3: FGP_FAIL_LOW
Bit 4: COIL_CURRENT_FAIL_LOW
Bit 5: RESERVED
Bit 6: RESERVED
Bit 7: POSITION_FAIL_LOW

Byte 4
Bit 0: RESERVED
Bit 1: RESERVED
Bit 2: RESERVED
Bit 3: RESERVED
Bit 4: ANALOG_INPUT_LOW_ERR
Bit 5: ANALOG_INPUT_HIGH_ERR
Bit 6: PWM_DUTY_CYCLE_LOW_ERR
Bit 7: PWM_DUTY_CYCLE_HIGH_ERR

Byte 5
Bit 0: BATTERY_VOLT_LOW_ERR
Bit 1: FGT_LOW_LIMIT_ERR
Bit 2: DELTA_P_LOW_LIMIT_ERR
Bit 3: FGP_LOW_LIMIT_ERR
Bit 4: BATTERY_VOLT_HIGH_ERR
Bit 5: FGT_HIGH_LIMIT_ERR
Bit 6: DELTA_P_HIGH_LIMIT_ERR
Bit 7: FGP_HIGH_LIMIT_ERR

Byte 6
Bit 0: RESERVED
Bit 1: WATCHDOG_RESET
Bit 2: RESERVED
Bit 3: RESERVED
Bit 4: CAN_FLOW_DEMAND_FAILED
Bit 5: RESERVED
Bit 6: TECJECT_SHUTDOWN
Bit 7: TECJET_INTERNAL_FAULT

Byte 7
Bit 0: RESERVED
Bit 1: KEYSWITCH_STATE
Bit 2: RESERVED
Bit 3: RESERVED
Bit 4: RESERVED
Bit 5: RESERVED
Bit 6: RESERVED
Bit 7: RESERVED

Byte 8
Bit 0: RESERVED
Bit 1: RESERVED
Bit 2: RESERVED
Bit 3: RESERVED
Bit 4: RESERVED
Bit 5: RESERVED
Bit 6: RESERVED
Bit 7: RESERVED

Receive PDO 1 - Gaseous Fuel Command
Maximum Reception rate: 3 ms (Engine Control to Tecjet50+)
Message type = "ASYNC" (does not require SYNC message)
Timeout: If Flow demand via CAN, the timeout for this message is adjustable
from 10 to 10,000ms.
COB Id: 530 (0x212) default for Node Id = 18. All others 512+Node Id.
Node ID = 18 (default address of TecJet when configured as TecJet #1)
Data length: 8 bytes

Bytes 1,2:Fuel specific gravity
Data length: 16 bits, integer
Resolution: 0.0001/bit, 0 offset (multiply by 10,000 before sending)
Range: 0.3101 to 2.0 (3101 to 20000 as scaled for transmission)
Upon receipt of this message if the specific gravity is within the allowed
range, the TecJet+ is updated.
The CAN data received is divided by 10,000 and multiplied by the density of
air, 1290.0 g/m^3 to get Normalized Density.

Bytes 3, 4: Ratio of Specific Heats (K)
Data length: 16 bits, integer
Resolution: 0.0001/bit, 0 offset (multiply by 10,000 before sending)
Range: 1.0001 to 2.0 (10001 to 20000 as scaled for
transmission)
Upon receipt of this message if the value is within the allowed range, the
TecJet+ will be updated with the raw data divided by 10,000.
If CAN data has not been received during the current power cycle, a default
parameter, K will be used as configured by the service tool.

Bytes: 5-8 Fuel Flow Rate
Data length: 4 bytes, unsigned
Resolution: 0.0002778 L/sec/bit, 0 offset
(Divide by 3600 to recover L/sec value)
Range: 0 to 1169744.78194 L/sec
If the received flow demand is 0.00 or greater than 1169.74478194 L/sec, the valve will be closed.
If the TecJet is configured to expect the Flow Command via PWM, the Flow Command in this message will be ignored. It can have any value since it will be completely ignored in that case.

CANopen Data Summary

PDO Summary
Node/PDO represents the Node ID + PDO combination from the standard connection set.

Name	CANopen		
	Node/PDO	Location	Type
Fuel specific gravity	18/1(R)	Bytes 1-2	UINT16
Ratio of Specific Heats	18/1(R)	Bytes 3-4	UINT16
Fuel Flow Rate	18/1(R)	Bytes 5-8	UINT32
Actual Fuel Valve Position	18/1(T)	Byte 1	UINT8
Desired Fuel Valve Position	18/1(T)	Byte 2	UINT8
Absolute Inlet Gas Pressure	18/1(T)	Bytes 3-4	UINT16
Absolute Outlet to Inlet Gas Pressure Differential	18/1(T)	Bytes 5-6	UINT16
Fuel Temperature	18/1(T)	Byte 7	UINT8
Gaseous Fuel Flow-Desired	18/2(T)	Bytes 1-4	UINT32
Gaseous Fuel Flow-Calculated	18/2(T)	Bytes 5-8	UINT32
Diagnostic Byte 1	18/3(T)	Byte 1	BYTE
Diagnostic Byte 2	18/3(T)	Byte 2	BYTE
Diagnostic Byte 3	18/3(T)	Byte 3	BYTE
Diagnostic Byte 4	18/3(T)	Byte 4	BYTE
Diagnostic Byte 5	18/3(T)	Byte 5	BYTE
Diagnostic Byte 6	18/3(T)	Byte 6	BYTE
Diagnostic Byte 7	18/3(T)	Byte 7	BYTE
Diagnostic Byte 8	18/3(T)	Byte 8	BYTE

SAE J1939 Communications

The TecJet 110, 50 Plus, and Precision Flow devices support CAN communications in the SAE J1939 Higher Layer Protocol format. Further detailed information regarding the J1939 Standards Collection can be purchased at **www.sae.org**. Information about CAN is at **www.semiconductors.bosch.de**. Specific information regarding TecJet behavior is detailed below.

All TecJet J1939 messages use the CAN 2.0B 29-bit Extended Data Frame Format.

Gaseous Fuel Command

Transmission rep rate:	5 ms (Engine Control ➜ TecJet 50 Plus)
Data length:	8 bytes
Data page:	0
PDU format:	239

Note that this is the only Proprietary PDU Format 1 message allowed in J1939.

PDU specific:	18, 125, 126, 127 depending on harness code
Default priority:	0 (high)
PGN:	0xEF12, 0xEF7D, 0xEF7E, 0xEF7F
Data:	

Bytes 1-2: Fuel specific gravity

Data length:	2 bytes, unsigned
Resolution:	0.0001/bit, 0 offset
Range:	0 to 2

Bytes 3-4: Ratio of Specific Heats

Data length:	2 bytes, unsigned
Resolution:	0.0001/bit, 0 offset
Range:	0 to 2

Bytes 5-8: Fuel Flow Rate

Data length:	4 bytes, unsigned
Resolution:	0.001 m^3/h/bit, 0 offset (normalized to 0 deg C, 1013 mbar
Range:	0 to 4211081.215 m^3/hr (1169744.78194 Liters/second)

Fuel Valve Position

Transmission repetition rate:	100 ms (TecJet 50 Plus ➜ Engine Control)
Data length:	8 bytes
Data Page:	0
PDU format:	255
PDU specific:	252
Default priority:	6
PGN:	65532 (0xFFFC)
Data:	

Byte 1: Actual Fuel Valve Position

Data length:	1 byte
Resolution:	0.4%/bit, 0 offset
Range:	0 to 100% (0x00 to 0xFA)

Byte 2: Desired Fuel Valve Position

Data length:	1 byte
Resolution:	0.4%/bit, 0 offset
Range:	0 to 100% (0x00 to 0xFA)

Bytes 3-8: Reserved, sent as 0xFF

Gas Properties

Transmission repetition rate:	100 ms (TecJet 50 Plus ➜ Engine Control)
Data length:	8 bytes
Data Page:	0
PDU format:	255
PDU specific:	253
Default priority:	6
PGN:	65533 (0xFFFD)
Data:	

Bytes 1-2: Absolute Inlet Gas Pressure

Data length:	2 byte
Resolution:	0.1 kPa/bit, 0 offset
Range:	0 to 6425.5 kPa

Bytes 3-4: Absolute Outlet to Inlet Gas Pressure Differential

Data length:	2 byte
Resolution:	0.1 kPa/bit, 0 offset
Range:	0 to 6425.5 kPa

Byte 5: Fuel Temperature

Data length:	1 byte
Resolution:	1 °C/bit gain, –40 °C offset
Range:	–40 to +210 °C

Bytes 6- 8: Reserved, sent as 0xFF

Gaseous Fuel Flow
Transmission repetition rate: 100 ms (TecJet 50 Plus ➔ Engine Control)
Data length: 8 bytes
Data Page: 0
PDU format: 255
PDU specific: 254
Default priority: 6
Parameter Group Number: 65534 (0xFFFE)
Data:
Bytes 1-4: Fuel Flow
    Data length: 4 bytes
    Resolution: 0.001 m^3/h/bit, 0 offset (normalized to 0 deg C, 1013 mbar
    Range: 0 to 4211081.215 m^3/hr
Bytes 5-8: Undefined, sent as 0xFF

Diagnostics and Status
Transmission Rate: 200 ms (TecJet 50 Plus ➔ Engine Control)
Data Length: 8 bytes
Data Page: 1
PDU Format: 255
PDU Specific: 255
Default Priority: 6
Parameter Group Number   65535 (0xFFFF)
Data Bytes: 8 bytes of status.

Byte 1 (Overall Status)
    Bit 0: OVERALL_STATUS_OK
    Bit 1: RESERVED
    Bit 2: ZERO_PRESSURE_DETECTED
    Bit 3: ZERO_FLOW_DETECTED
    Bit 4: FLOW_NOT_REACHED
    Bit 5: VALVE_POSITION_ERROR
    Bit 6: HIGH_ELEC_TEMP
    Bit 7: RESERVED
Byte 2
    Bit 0: ELEC_TEMP_FAIL_HIGH
    Bit 1: FGT_FAIL_HIGH
    Bit 2: DELTA_P_FAIL_HIGH
    Bit 3: FGP_FAIL_HIGH
    Bit 4: COIL_CURRENT_FAIL_HIGH
    Bit 5: RESERVED
    Bit 6: RESERVED
    Bit 7: POSITION_FAIL_HIGH
Byte 3
    Bit 0: ELEC_TEMP_FAIL_LOW
    Bit 1: FGT_FAIL_LOW
    Bit 2: DELTA_P_FAIL_LOW
    Bit 3: FGP_FAIL_LOW
    Bit 4: COIL_CURRENT_FAIL_LOW
    Bit 5: RESERVED
    Bit 6: RESERVED
    Bit 7: POSITION_FAIL_LOW
Byte 4
    Bit 0: RESERVED
    Bit 1: RESERVED
    Bit 2: RESERVED
    Bit 3: RESERVED
    Bit 4: ANALOG_INPUT_LOW_ERR
    Bit 5: ANALOG_INPUT_HIGH_ERR
    Bit 6: PWM_DUTY_CYCLE_LOW_ERR
    Bit 7: PWM_DUTY_CYCLE_HIGH_ERR

Byte 5

Bit 0: BATTERY_VOLT_LOW_ERR
Bit 1: FGT_LOW_LIMIT_ERR
Bit 2: DELTA_P_LOW_LIMIT_ERR
Bit 3: FGP_LOW_LIMIT_ERR
Bit 4: BATTERY_VOLT_HIGH_ERR
Bit 5: FGT_HIGH_LIMIT_ERR
Bit 6: DELTA_P_HIGH_LIMIT_ERR
Bit 7: FGP_HIGH_LIMIT_ERR

Byte 6

Bit 0: RESERVED
Bit 1: WATCHDOG_RESET
Bit 2: RESERVED
Bit 3: RESERVED
Bit 4: CAN_FLOW_DEMAND_FAILED
Bit 5: RESERVED
Bit 6: TECJECT_SHUTDOWN
Bit 7: TECJET_INTERNAL_FAULT

Byte 7

Bit 0: RESERVED
Bit 1: KEYSWITCH_STATE
Bit 2: RESERVED
Bit 3: RESERVED
Bit 4: RESERVED
Bit 5: RESERVED
Bit 6: RESERVED
Bit 7: RESERVED

Byte 8

Bit 0: RESERVED
Bit 1: RESERVED
Bit 2: RESERVED
Bit 3: RESERVED
Bit 4: RESERVED
Bit 5: RESERVED
Bit 6: RESERVED
Bit 7: RESERVED

Address Claimed

The Address Claimed message will be sent out shortly after power has been applied to the TecJet 50 Plus if the TecJet is configured for the EGS-02 Flow Demand mode.
The Address Claimed message will be sent out in response to a Request for Address Claimed if the preferred address was successfully claimed or if the TecJet has not won or lost address claiming.
The Request for Address Claimed can be sent to a specific Address or to the Global Destination Address, 255. The TecJet 50 Plus will respond to a specific query, or one to the Global Destination Address, 255
The Source Address for this transmit message will be 18 for TecJet 1, 125 for TecJet 2, 126 for TecJet 3, 127 for TecJet 4. Addresses are not re-programmable.
The Address Claimed Message will also be sent out if the TecJet 50 Plus receives an Address Claimed message from the same Address as the receiving node and a lower priority (higher value) NAME. The entire 8-byte value of the NAME is used for arbitration with the Arbitrary Address Capable Field as the Most Significant Bit.
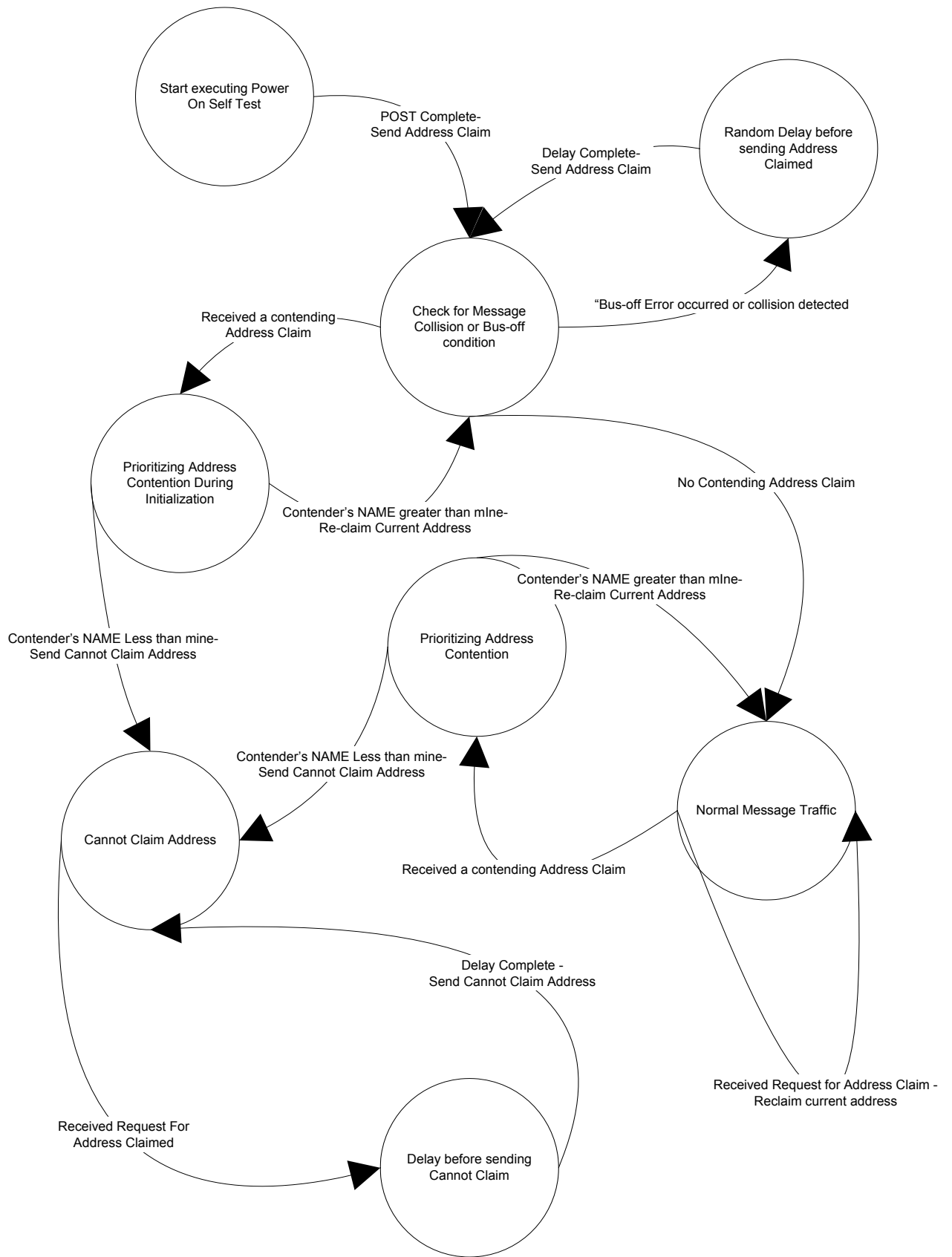
Start executing Power On Self Test

POST Complete-
Send Address Claim

Delay Complete-
Send Address Claim

Random Delay before sending Address Claimed

Check for Message Collision or Bus-off condition

"Bus-off Error occurred or collision detected

Received a contending Address Claim

Prioritizing Address Contention During Initialization

Contender's NAME greater than mIne-
Re-claim Current Address

No Contending Address Claim

Contender's NAME greater than mIne-
Re-claim Current Address

Prioritizing Address Contention

Contender's NAME Less than mine-
Send Cannot Claim Address

Contender's NAME Less than mine-
Send Cannot Claim Address

Cannot Claim Address

Received a contending Address Claim

Normal Message Traffic

Delay Complete -
Send Cannot Claim Address

Received Request for Address Claim -
Reclaim current address

Received Request For Address Claimed

Delay before sending Cannot Claim

Figure 3-1. Address Claimed State Chart

▌Cannot Claim Address

> The Cannot Claim Address message will be sent out if the TecJet 50 Plus
> receives an Address Claimed message with the same Source Address as the
> receiving node and with a higher priority (lower value) NAME. The entire 8-byte
> value of the NAME is used for arbitration with the Arbitrary Address Capable
> Field as the Most Significant Bit.
>
> The Cannot Claim Address will also be sent out in response to a Request for
> Address Claimed if the address was unsuccessfully claimed.
>
> The Cannot Claim Address message will be sent out with a 0-153 millisecond
> pseudo-random delay between the reception of the triggering message and the
> transmission of the Cannot Claim Address message.
>
> If the TecJet 50 Plus cannot claim an Address a status bit will be set and the
> valve will shut down.

▌TecJet 50 Plus NAME

> Arbitrary Address Capable Field = No = 0
>   (See J1939-81 Section 4.1.1.2)
> Industry Group Field = Global = 0
>   (See J1939 Section 3.2.4, J1939-81 Section 4.1.1.3)
> Vehicle System Instance Field = First Instance = 0
>   (See J1939-81 Section 4.1.1.4)
> Vehicle System Field = Non-specific system = 0
>   (See J1939-81 Section 4.1.1.5)
> Function Field = Fuel System = 15
>   (See J1939-81 Section 4.1.1.7)
> Function Instance Field = First = 0
>   (See J1939-81 Section 4.1.1.8)
> ECU Instance Field = 1, 2, 3, 4 corresponding to Address 18, 125, 126, 127
>   respectively
>   (See J1939-81 Section 4.1.1.9)
> Manufacturer Code Field = Woodward Governor Industrial Controls = 153
>   (See J1939-81 Section 4.1.1.10)

Position Hold Feature

⚠ **WARNING**	**This feature should only be used by qualified engine operators. This feature will hold the valve at the desired position regardless of the fuel demand from the engine controller, which could result in unexpected engine operation.**

The TecJet 110, 50 Plus, and Precision Flow devices have a position hold
feature for use in analyzing or troubleshooting engine system operation. This
allows qualified operators to bypass the normal flow control function and specify
a fixed valve position. This mode is accessed in the Service Tool using the Tools
→ Position Hold menu which can only be accessed with a password supplied by
Woodward.

The current valve position is displayed in the Position Hold dialog box. The valve
remains in flow control mode while the Enable Position Hold check-box is
unchecked. After the desired position is entered in the Position Hold Setting,
checking the Enable Position Hold check-box causes the valve to operate in
position hold mode where the valve position is controlled at the Position Hold
Setting value. Un-checking the Enable Position Hold check-box restores normal
flow control operation. Pressing OK closes the Position Hold window without
changing the position hold settings. Position Hold is automatically disabled after
10 minutes. It is also disabled if the service tool connection is lost for more than
10 seconds.

The Position Hold feature requires a valid flow command for position hold to function. The command is not used for positioning, but in order to control the position, the flow command must be valid. The position limiter function is also active so it may not be possible to achieve the desired position without increasing the flow demand. See the section "Position Limiter" earlier in this chapter. To avoid confusion, it is recommended to first achieve the desired flow, note the position, enter this position into the Position Hold setting, then activate the Position Hold feature. This process will avoid interaction with the Position Limiter unless the fuel pressure changes.

General Specifications

Electrical Input Characteristics

Input Voltage Range:	18–32 Vdc
Maximum Steady State Input Current:	2 A
Maximum Transient Input Current:	5 A

Mechanical Characteristics

Valve Maximum Effective Area:

TJ50P	1355 mm² (2.1 in²)
TJ50PPF	181 mm² (0.280 in²)

Valve Minimum Effective Area:

TJ50P	25.8 mm² (0.040 in²)
TJ50PPF	3.2 mm² (0.005 in²)
	See section on valve sizing for detailed information.

Weight:	24 kg (52 lb)
Mounting:	See installation drawings

Fuel connections

Filter Requirements:	less than 50.0 μm
	See outline drawing for additional details.

Dynamics

Position Response:	–3 db at > 7 Hz, with 1400%/second slew rate limit, 2 ms dead time. Overshoot < 1%
Demanded Flow Response:	Same as position loop response with addition of 3 ms flow loop update rate
Pressure Change Rejection:	Same as demanded flow response with addition of 10 ms lag on P1 measurement, 100 ms lag on delta pressure

Environmental

Fuel Type
The TecJet 50 Plus operates on gases ranging from pipeline quality natural gas to specialty gas (such as landfill, digester, or other biogases). The TecJet 50 Plus Precision Flow operates on gases ranging from pipeline quality natural gas to propane. Proper application of the valve for fuel flow, FGP, energy content, etc., is the responsibility of the OEM. The fuel gas flowing through the valve can consist of the following compounds with limits if they apply:

Component	Specification
Gaseous hydrocarbons (methane, ethane, propane, etc.):	No limit
Carbon monoxide:	No limit
Carbon dioxide:	No limit
Hydrogen:	<10%
Oxygen:	No limit
Nitrogen:	No limit
Sulfur compounds including hydrogen sulfide:	
TJ50P	< 500 mg/10 kWh (< 2000 mg/10 kWh)
TJ50PPF	<40 mg/10 kWh
Chlorine and fluorine compounds (typically chlorofluorocarbons):	< 100 mg/10 kWh (< 400 mg/10 kWh)
Silicon:	< 5 mg/10 kWh (< 20 mg/10 kWh)
Ammonia:	< 50 mg/10 kWh
Oil or hydrocarbons in liquid (mist form):	< 5 mg/10 kWh
Fine particulates, including silicon (less than 1.0 µm):	< 3 mg/10 kWh

Overall the gas SG should be between 0.4 to 2.0 for the TJ50P and between 0.4 and 1.6 for the TJ50PPF. The energy content should be between 1 and 9.5 kWh/nm³. The values in ( ) are allowed, but may result in reduced valve life. The above fuel limits can be converted to ppm by multiplying the given number by the LHV of the fuel in question, then dividing by 36. The LHV must be in units of MJ/kg.

Pressures
Inlet fuel gas pressure (FGP) should normally be between 876 and 1289 mbar absolute. Keep in mind that for a given gauge FGP value, absolute FGP will decrease with increasing altitude above sea level. The Inlet FGP sensor will compensate for barometric pressure to 3000 m. Pressures below 876 mbar are allowed at high load operation assuming that the gas differential pressure requirements are still met.

The TJ50P fuel gas differential pressure (delta-p) should be between 69 and 345 mbar. Delta-p below this range is allowed during cranking and idle conditions, but accuracy of the valve will be reduced. For delta-p above 276 mbar, flow accuracy will also decrease, and a reduction in valve stability may occur. Refer to the Accuracy section later in this chapter for further details.

The TJ50PPF fuel gas differential pressure (delta-p) should be between 51 and 276 mbar. Delta-p below this range is allowed during cranking and idle conditions, but accuracy of the valve will be reduced. Delta-p above 276 mbar is not recommended. Refer to the Accuracy section later in this chapter for further details.

Minimum proof pressure for the TecJet is 0.52 bar gauge. Minimum burst pressure for the TecJet is 1.72 bar gauge.

Temperature
The following are the temperature specifications for the TecJet:

- Steady State Case Temperature: –20 to +90 °C (–4 to +194 °F)
- Stead State Ambient Temperature: –20 to +85 °C (–4 to 185 °F)*
- Long Term Storage Temperature: –40 to +40 °C (–40 to +104 °F)**
- Short Term Storage Temperature: –40 to +105 °C (–40 to +221 °F) **
- Fuel Gas Inlet Temperature: 0 to 65 °C (32 to 149 °F)

* The actuator case temperature is limited to 95 °C (203 °F). If the actuator is running under high steady-state load continuously, then the ambient temperature should be limited to 75 °C (167 °F).
** The unit is un-powered during storage temperature.

Vibration and Shock

Random Vibration:	Exceeds WGC RV2, 10–2000 Hz @ 0.1 G²/Hz (12.8 Grms)
Shock:	Per US MIL-STD-810C, Method 516.2, Procedure 1, (40 g)

Flow Characteristics

Accuracy
The TecJet meters fuel accurately such that the engine starts consistently and accelerates smoothly to idle speed. The required fuel delivery up to 7% of valve maximum rated effective area is within ±20% of the mass flow demand. Throughout the load range, from idle to 100% load, the TecJet regulates the fuel delivery accurately relative to the fuel flow demand in order to reduce combustion emissions and protect the engine against detonation. The accuracy is within ±10% of the mass flow demand from >7% to 25% of valve maximum rated effective area and within ±6% of the mass flow demand above 25% of valve maximum rated effective area.

For delta-p above 275 mbar, an additional 1.5%, 1%, and 0.5%, respectively, should be added to the accuracy values stated above. Delta pressure below the minimum specified delta pressure will also significantly affect the accuracy values stated above.

Chapter 4.
Valve Sizing

Figures 4-1 through 4-4 show the maximum and minimum amounts of gas that the TecJet™ 50 Plus and TecJet 50 Plus Precision Flow will flow as a function of pressure differential in kPa(d). Figures 4-1 and 4-2 indicate flow values for specialty gas, while Figures 4-3 and 4-4 indicate flow values for natural gas. Plots for the TecJet 110 and the TecJet 50 are also shown for comparison purposes.

Comparing the TecJet vs Application Maximum Flow Rate
Choose the correct graph depending on your application flow media. Determine the maximum flow rate for your application in a metric mass flow rate (kg/h). Increase this value by 15% to ensure that the TecJet will handle the maximum flow requirement under all conditions. Find this increased flow value on the left-side Y-axis of the graph. Next, determine the approximate valve pressure drop at the actual maximum flow for your application. Locate this value on the X-axis of the graph. Metric [kPa(d)] units are provided. Note that the graphs assume the application outlet pressure is at sea level atmospheric pressure. Take the increased flow rate value and the pressure drop value, and determine where they cross on the graph. This is the maximum flow operating point for your application. This point should fall below the maximum flow plot for the TecJet in question.

Comparing the TecJet vs Application Minimum Flow Rate
Choose the correct graph depending on your application flow media. Determine the minimum flow rate for your application in a metric mass flow rate (kg/h). Reduced this value by 10% to ensure that the TecJet will handle the minimum flow requirement under all conditions. Find this reduced flow value on the right-side Y-axis of the graph. Next, determine the approximate valve pressure drop at the actual minimum flow for your application. Locate this value on the X-axis of the graph. Metric [kPa(d)] units are provided. Note that the graphs assume the application outlet pressure is at sea level atmospheric pressure. Take the reduced flow rate value and the pressure drop value, and determine where they cross on the graph. This is the minimum flow operating point for your application. This point should fall above the minimum flow plot for the TecJet in question.
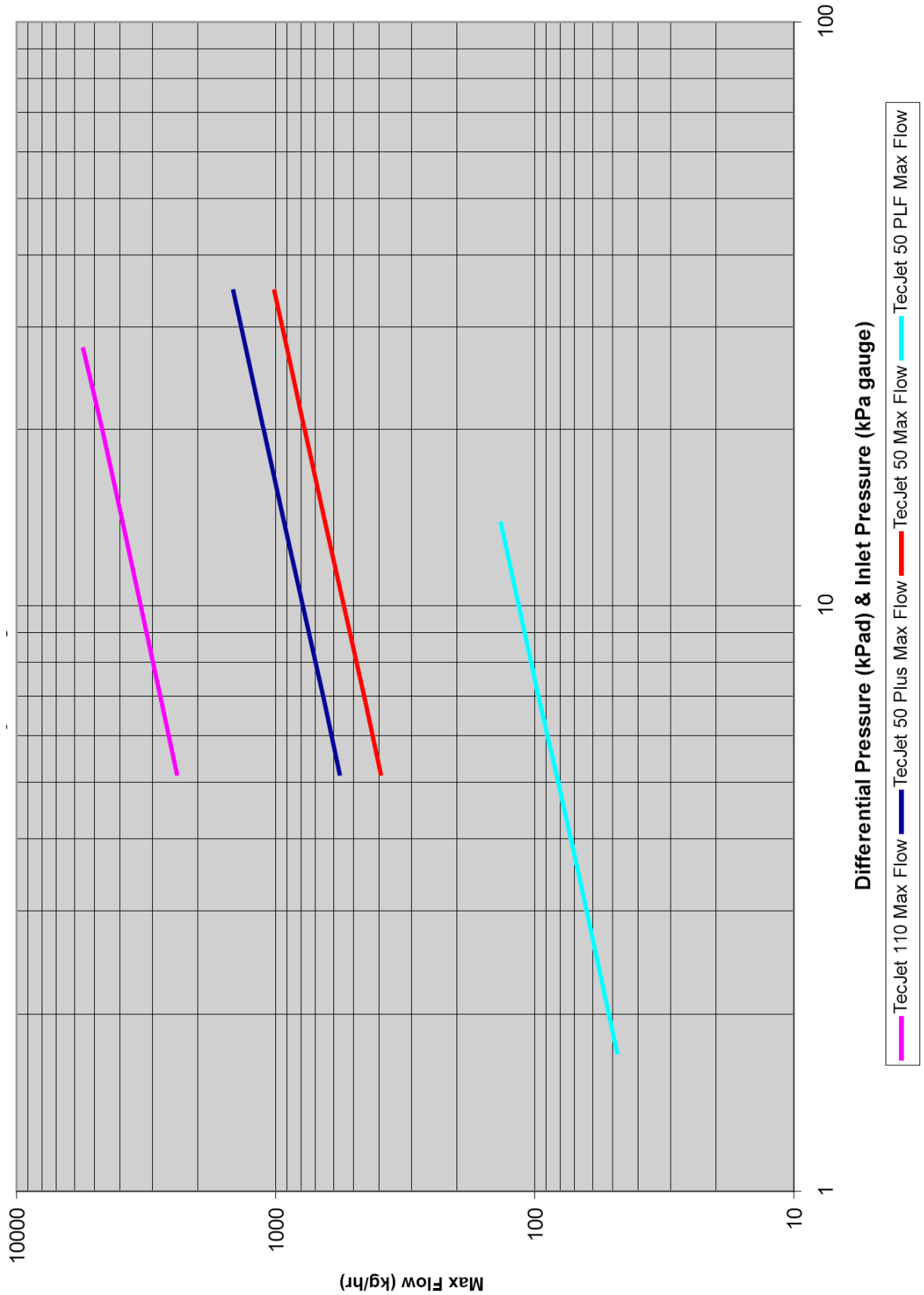
Figure 4-1. Maximum Specialty Gas Flow Capacity of TecJet 50 Plus, 50 Plus
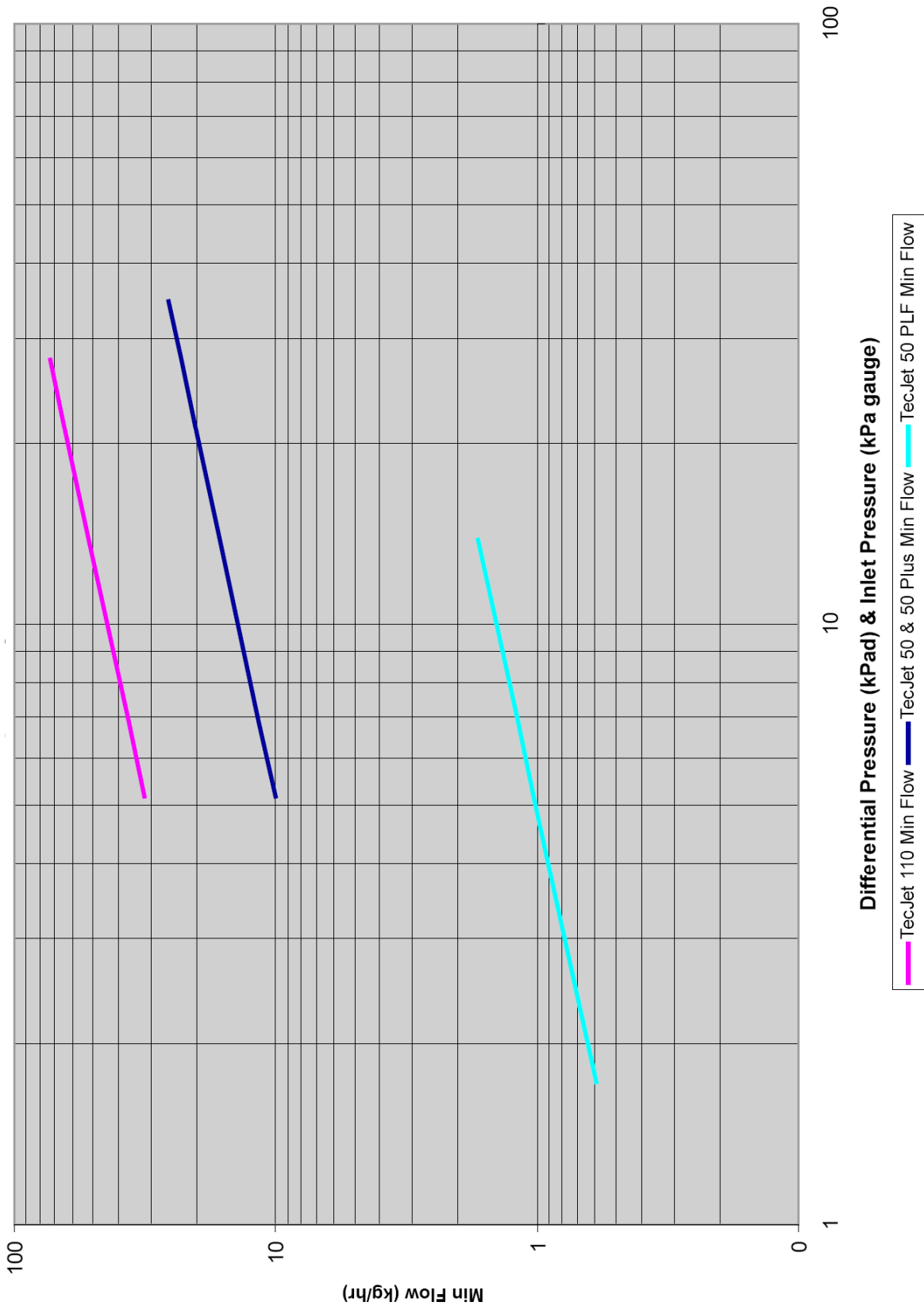Precision Flow, 50, and 110
(Specialty Gas, SG=1, Sea Level)

Figure 4-2. Minimum Specialty Gas Flow Capacity of TecJet 50 Plus, 50 Plus
Precision Flow, 50, and 110
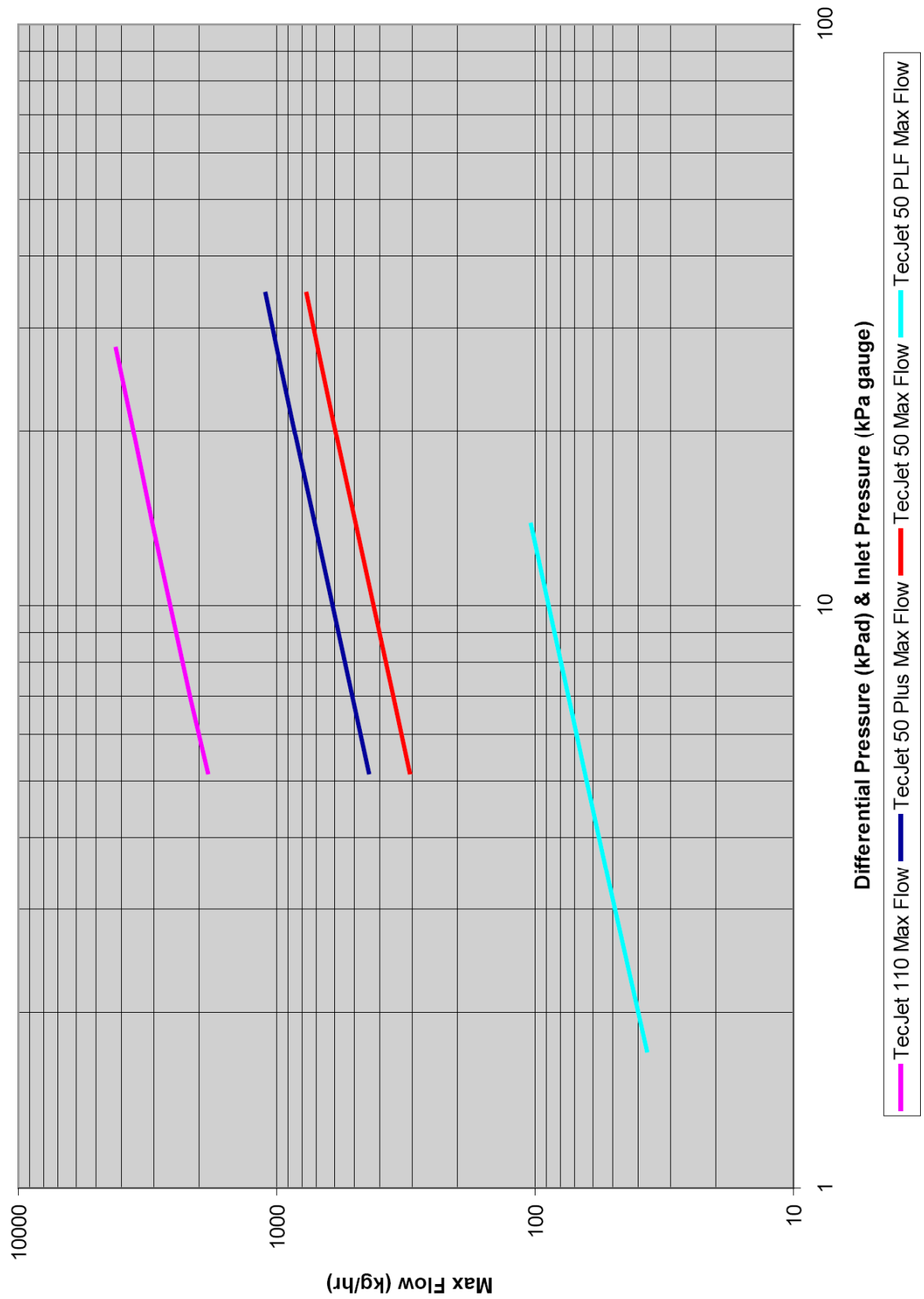(Specialty Gas, SG=1, Sea Level)

Figure 4-3. Maximum Natural Gas Flow Capacity of TecJet 50 Plus, 50 Plus
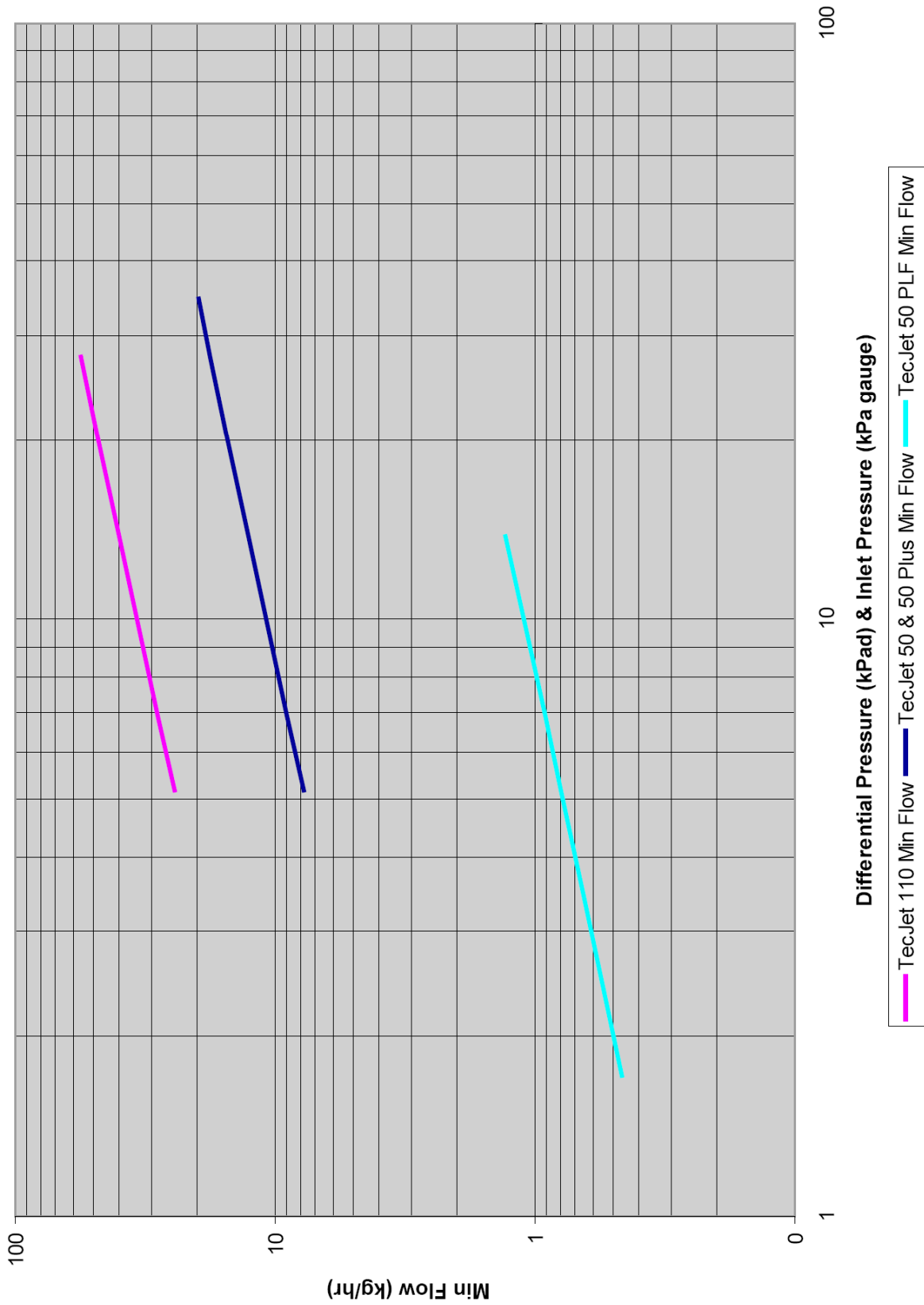Precision Flow, 50, and 110
(Natural Gas, SG=0.6, Sea Level)

Figure 4-4. Minimum Natural Gas Flow Capacity of TecJet 50 Plus, 50 Plus
Precision Flow, 50, and 110
(Natural Gas, SG=0.6, Sea Level)

Chapter 5.
Troubleshooting

The tables in this chapter refer to status indications, warnings, and errors that can be viewed on the service tool. See Chapter 6 for information on installing the service tool.

⚠ WARNING	**The actions described may not be appropriate for all situations. The operator should verify that any actions taken while troubleshooting will not take equipment outside of specification, and will not damage property or result in dangerous situations. Also check with the local safety authority.**

STATUS INDICATIONS			
Status	**Description**	**Possible Cause**	**Possible Actions**
Flow Not Reached	The Flow demand is greater than the maximum flow possible for the present conditions.	Inlet Gas pressure and/or the pressure across the valve too low, excessive pressure drop in fuel system.	Check if the filters, valve(s) and other restrictions upstream of the TecJet valve are clean and operating correctly.
		Inlet gas pressure and/or the pressure across the valve is too low, pressure regulator problem.	Adjust the inlet gas pressure to the correct value.
		Gas properties do not match used gas parameters	Verify the configured (Analog or PWM flow demand) or received (EGS CAN or Jenbacher CAN flow demand) gas parameters
		The wrong size TecJet has been chosen for this application.	Check the valve sizing for this engine.
Zero Pressure Detected	The differential pressure across the valve is less than 6 mbar.	Engine is not running, fuel pressure is not present at the valve inlet.	Status indication, no action required.
		Excessive pressure drop in fuel system.	Check if the filters, valve(s) and other restrictions upstream of the TecJet valve are clean and operating correctly.
		Pressure regulator problem.	Adjust the inlet gas pressure to the correct value.
Zero Flow Detected (Flow demand source is Jenbacher CAN or EGS)	If the CAN Flow Demand Failed warning is not active, the received value is zero. If the CAN Flow Demand Failed warning is active, the time between flow demand messages exceeds the CAN flow demand timeout value. See the CAN Flow Demand Failed entry in the warnings section.	ECM is requesting zero flow.	Status indication, no action required.

STATUS INDICATIONS			
Status	**Description**	**Possible Cause**	**Possible Actions**
Zero Flow Detected (Flow demand source is PWM)	If the PWM flow demand high/low warnings are not active, the flow demand is zero. If the PWM Flow Demand High or PWM Flow Demand Low warning is active, the flow demand is out of range. See the corresponding entries in the warnings section.	ECM is requesting zero flow.	Status indication, no action required.
Zero Flow Detected (Flow demand source is Analog 4-20)	If the Analog Flow Demand Low/High warnings are not active, the flow demand is zero. If the Analog Flow Demand Low or Analog Flow Demand High warning is active, the flow demand is out of range. See the corresponding entries in the warnings section.	ECM is requesting zero flow.	Status indication, no action required.

⚠ WARNING   **WARNINGS**

Warning	Description	Possible Cause	Possible Actions
Analog Flow Demand High	The analog flow demand exceeds the analog flow demand maximum fail limit.	Analog input wiring problem.	Check the analog input wiring for shorts, open connections and intermitted contacts.
		Analog input current is out of range.	Ensure that the analog input signal is within the configured range. The service tool displays the analog input current and the range limits.
Analog Flow Demand Low	The analog flow demand is below the analog flow demand minimum fail limit.	Analog input wiring problem.	Check the analog input wiring for shorts, open connections and intermitted contacts.
		Analog input current is out of range.	Ensure that the analog input signal is within the configured range. The service tool displays the analog input current and the range limits.

⚠️**WARNING** WARNINGS

Warning	Description	Possible Cause	Possible Actions
CAN Flow Demand Failed	The CAN flow demand is not being received. The time between messages must be less than the CAN flow demand timeout value.	Incorrect TecJet Number.	Check the CAN ID inputs to the valve.
		ECM is not sending Qgn messages, or is not sending to the correct TecJet number.	Verify that the ECM is powered up and sending valid Qgn messages, and that the correct TecJet ID numbers are selected.
		CAN termination problem.	Check if the CANbus has the right termination resistor connected at both ends of the bus.
		CAN wiring problem.	Check the CAN wiring for shorts, open connections, interchanged connections, and intermittent contacts.
		CAN noise problem.	Verify that the CAN wiring is installed according to the installation instruction
		CANbus incompatibility with ECM, e.g., baud rate.	Verify ECM CANbus compatibility.
		CAN traffic overload.	Verify that there is not excessive CAN traffic that has higher priority than the TecJet flow demand message.
Coil Current High	There is an internal problem with either the torque motor that operates the valve or with the electronics used to control the torque motor. Depending on the problem, the valve is either unable to operate properly or is unable to achieve full performance.	Internal fault.	Replace valve.
Coil Current Low	There is an internal problem with either the torque motor that operates the valve or with the electronics used to control the torque motor. Depending on the problem, the valve is either unable to operate properly or is unable to achieve full performance.	Internal fault.	Replace valve.
Delta P High	The Delta Pressure value exceeds the delta pressure high warning threshold.	Warning threshold improperly configured.	Configure warning threshold for value appropriate to the application.
		Pressure regulator adjusted too high.	Adjust pressure regulator.

⚠️**WARNING**   WARNINGS

Warning	Description	Possible Cause	Possible Actions
Delta P Low	The Delta Pressure value is below the delta pressure low warning threshold.	Warning threshold improperly configured. Valve is installed backwards.	Configure warning threshold for value appropriate to the application. Verify that gas flow is in the direction of the arrow on the valve.
Electrical Temperature High	The valve internal temperature has risen too high to allow full-power operation. The torque available to move the valve is reduced and the valve may not meet specified performance levels.	Valve ambient temperature is too high. Internal fault.	Reduce ambient temperature. Replace the valve.
Electronics Temperature High	The internal electronics temperature sensor has failed to a high value. The valve may not reach specified performance.	Internal fault.	Replace the valve.
Electronics Temperature Low	The internal electronics temperature sensor has failed to a low value. The valve may not reach specified performance.	Internal fault.	Replace the valve.
Fuel Gas Pressure High	The Fuel Gas Pressure value exceeds the fuel gas pressure high warning threshold.	Warning threshold improperly configured. Pressure regulator adjusted too high. Faulty or slow pressure regulator.	Configure warning threshold for value appropriate to the application. Adjust pressure regulator. Verify proper pressure regulator operation.
Fuel Gas Pressure Low	The Fuel Gas Pressure value is below the fuel gas pressure low warning threshold.	Warning threshold improperly configured. Improper engine shutdown sequence.	Configure warning threshold for value appropriate to the application and the elevation of the site. Verify proper engine shutdown sequence.
Fuel Gas Pressure Sensor High	The Fuel Gas Pressure sensor has failed to a high value. The fuel gas pressure value is derived from the default downstream pressure table instead.	Internal fault.	Replace valve.
Fuel Gas Pressure Sensor Low	The Fuel Gas Pressure sensor has failed to a low value. The fuel gas pressure value is derived from the default downstream pressure table instead.	Internal fault.	Replace valve.
Fuel Gas Temperature High	The Fuel Gas Temperature value exceeds the fuel gas temperature high warning threshold.	Warning threshold improperly configured. Fuel temperature is above warning threshold.	Configure warning threshold for value appropriate to the application. Correct fuel temperature problem.

⚠**WARNING**   **WARNINGS**

Warning	Description	Possible Cause	Possible Actions
Fuel Gas Temperature Low	The Fuel Gas Temperature value is below the fuel gas temperature low warning threshold.	Warning threshold improperly configured. Fuel temperature is below warning threshold.	Configure warning threshold for value appropriate to the application. Correct fuel temperature problem.
Fuel Gas Temperature Sensor High	The Fuel Gas Temperature sensor has failed to a high value and the default fuel gas temperature is being used instead.	Internal fault.	Replace valve.
Fuel Gas Temperature Sensor Low	The Fuel Gas Temperature sensor has failed to a low value and the default fuel gas temperature is being used instead.	Internal fault.	Replace valve.
Input Voltage High	The battery voltage seen by the valve is above the limit specified in the manual.	Faulty battery or supply. Faulty or no battery charger. Improper wiring.	Check battery or supply for correct operation. Check battery charger for correct operation. Check wiring for correct size, length, contacts, fuses.
Input Voltage Low	The battery voltage seen by the valve is below the limit specified in the manual.	Faulty battery or supply. Faulty or no battery charger. Improper wiring.	Check battery or supply for correct operation. Check battery charger for correct operation. Check wiring for correct size, length, contacts, fuses.
PWM Flow Demand High	The PWM flow demand exceeds the PWM flow demand maximum duty cycle fail limit.	PWM wiring problem. PWM frequency is out of range. PWM duty cycle is out of range.	Check the PWM input wiring for shorts, open connections and intermitted contacts. Verify that the PWM frequency from the ECM is within specified limits. Ensure that the PWM signal is within the configured range. The service tool displays the PWM frequency, duty cycle, and range limits.
PWM Flow Demand Low	The PWM flow demand is below the PWM flow demand minimum duty cycle fail limit.	PWM wiring problem. PWM frequency is out of range. PWM duty cycle is out of range.	Check the PWM input wiring for shorts, open connections and intermitted contacts. Verify that the PWM frequency from the ECM is within specified limits. Ensure that the PWM signal is within the configured range. The service tool displays the PWM frequency, duty cycle, and range limits.

ERRORS	
When an error occurs, the valve closes, if possible. It will not attempt to operate again until power to the valve is cycled. If the error persists, the valve must be replaced.	
Error	**Description**
Shutdown	One or more of the errors below is active.
Internal Error	The valve has detected an internal error that prevents it from operating.
Delta P Sensor High	The delta P sensor has failed to a high value.
Delta P Sensor Low	The delta P sensor has failed to a low value.
Position Sensor High	The position sensor has failed to a high value.
Position Sensor Low	The position sensor has failed to a low value.
Position Error	The actuator was not able to position the valve properly.

Chapter 6.
Service Tool Installation

Detailed information on the TecJet™ is contained in the TecJet Service Tool, which can be found on the web at: **www.woodward.com/software**. Select software product "**TecJet Tools**". Follow the installation instructions given on that page.

TecJet Users Guide

After the service tool has been installed, from the Windows Start menu, select **Programs**, then **Woodward**, then **TecJet Service Tool**, then select **TecJet Service Tool**. Once the service tool has started, select **Help** from the menu, and then select **User's Guide**. The User Guide describes how to configure the valve, and how to monitor operation using the service tool.

Chapter 7.
Maintenance

General

Build-up of deposits near the metering area of the TecJet™ 50 Plus can develop depending on the quality of the gas being metered. This build-up can affect the performance of the TecJet and may appear as degradation of actual flow vs command flow accuracy, or as flow control instability.

IMPORTANT	This procedure does not apply to the TecJet 50 Plus Precision Flow version.

Limits of Applicability

Periodic cleaning may be performed and needed to ensure the best operation of the TecJet. It is the customer's responsibility to monitor the need for valid scheduled maintenance, as this will vary depending on the quality of the gas in the particular application.

The procedure below has been tested and validated for a particular gas environment (mineral deposits); the applicability to other gaseous environment needs to be validated by the OEM at the customer site.

Cleaning Procedure

When cleaning the metering element and the inside of the valve body, do not use sharp objects that may scrape or dent the metering elements, as this could degrade the accuracy of the valve. Any damage to the internal geometry of the TecJet, especially the valve plate or bore area around the valve plate, will change the calibration of the valve and void the warranty. High pressure washing is not recommended. There are no components of the TecJet that are replaceable or serviceable. Make sure that the power is disconnected before removing the TecJet 50 Plus main connector.

A petrochemical solvent is recommended to clean (wash and brush) the valve when minimal film/patina build up is observed.

In applications where solids (mineral deposits) are found in the gas, the following procedure should be used (this procedure can be performed at the site):

- Position the TecJet in the fully open position.
- Place a plugged piece of tubing over the P1 probe to completely seal the probe.
- Place a plug in the P2 port to completely seal it.
- Cap/seal the inlet flange of the TecJet.
- Fill the TecJet with a solution of 60 °C water and 2 tablespoons of Dawn (or equivalent) dishwashing detergent.
- Cap/seal the outlet flange of the TecJet.
- Leave soap solution in the TecJet for 24 to 30 hours.

- Remove the cap/seal on the outlet flange of the TecJet.
- Dump the soap solution out of TecJet.
- Fill the TecJet with fresh 60 °C tap water and move the water around in the valve bore with a long plastic rod or equivalent.
- Dump the rinse water out of the TecJet.
- Fill the TecJet again with fresh 60 °C tap water and move the water around in the valve bore with a long plastic rod or equivalent.
- Dump the rinse water out of the TecJet.
- Remove the cap/seal on the inlet flange of the TecJet.
- Inspect the valve plate and bore area around the valve plate for any remaining contamination.
- Use a soft plastic brush, or equivalent, to gently remove any remaining contamination and rinse with tap water as necessary.
- Remove the tubing from the P1 probe.
- Remove the plug from the P2 port.
- Leave the valve bore open to air until completely dry.
- If contamination has been successfully removed, return the valve to service.
- If contamination still exists on the valve plate and/or bore area around the valve plate, the unit will need to be replaced with a new unit.

Chapter 8.
Service Options

Product Service Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:
- Consult the troubleshooting guide in the manual.
- Contact the manufacturer or packager of your system.
- Contact the Woodward Full Service Distributor serving your area.
- Contact Woodward technical assistance (see "How to Contact Woodward" later in this chapter) and discuss your problem. In many cases, your problem can be resolved over the phone. If not, you can select which course of action to pursue based on the available services listed in this chapter.

OEM and Packager Support: Many Woodward controls and control devices are installed into the equipment system and programmed by an Original Equipment Manufacturer (OEM) or Equipment Packager at their factory. In some cases, the programming is password-protected by the OEM or packager, and they are the best source for product service and support. Warranty service for Woodward products shipped with an equipment system should also be handled through the OEM or Packager. Please review your equipment system documentation for details.

Woodward Business Partner Support: Woodward works with and supports a global network of independent business partners whose mission is to serve the users of Woodward controls, as described here:

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.

- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.

- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.

- A **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

A current list of Woodward Business Partners is available at **www.woodward.com/support**.

Woodward Factory Servicing Options

The following factory options for servicing Woodward products are available through your local Full-Service Distributor or the OEM or Packager of the equipment system, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is originally shipped from Woodward or a service is performed:

- Replacement/Exchange (24-hour service)
- Flat Rate Repair
- Flat Rate Remanufacture

Replacement/Exchange: Replacement/Exchange is a premium program designed for the user who is in need of immediate service. It allows you to request and receive a like-new replacement unit in minimum time (usually within 24 hours of the request), providing a suitable unit is available at the time of the request, thereby minimizing costly downtime. This is a flat-rate program and includes the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205).

This option allows you to call your Full-Service Distributor in the event of an unexpected outage, or in advance of a scheduled outage, to request a replacement control unit. If the unit is available at the time of the call, it can usually be shipped out within 24 hours. You replace your field control unit with the like-new replacement and return the field unit to the Full-Service Distributor.

Charges for the Replacement/Exchange service are based on a flat rate plus shipping expenses. You are invoiced the flat rate replacement/exchange charge plus a core charge at the time the replacement unit is shipped. If the core (field unit) is returned within 60 days, a credit for the core charge will be issued.

Flat Rate Repair: Flat Rate Repair is available for the majority of standard products in the field. This program offers you repair service for your products with the advantage of knowing in advance what the cost will be. All repair work carries the standard Woodward service warranty (Woodward Product and Service Warranty 5-01-1205) on replaced parts and labor.

Flat Rate Remanufacture: Flat Rate Remanufacture is very similar to the Flat Rate Repair option with the exception that the unit will be returned to you in "like-new" condition and carry with it the full standard Woodward product warranty (Woodward Product and Service Warranty 5-01-1205). This option is applicable to mechanical products only.

Returning Equipment for Repair

If a control (or any part of an electronic control) is to be returned for repair, please contact your Full-Service Distributor in advance to obtain Return Authorization and shipping instructions.

When shipping the item(s), attach a tag with the following information:
• return number;
• name and location where the control is installed;
• name and phone number of contact person;
• complete Woodward part number(s) and serial number(s);
• description of the problem;
• instructions describing the desired type of repair.

Packing a Control

Use the following materials when returning a complete control:
• protective caps on any connectors;
• antistatic protective bags on all electronic modules;
• packing materials that will not damage the surface of the unit;
• at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
• a packing carton with double walls;
• a strong tape around the outside of the carton for increased strength.

NOTICE	**To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.**

Replacement Parts

When ordering replacement parts for controls, include the following information:
• the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
• the unit serial number, which is also on the nameplate.

Engineering Services

Woodward offers various Engineering Services for our products. For these services, you can contact us by telephone, by email, or through the Woodward website.

- Technical Support
- Product Training
- Field Service

Technical Support is available from your equipment system supplier, your local Full-Service Distributor, or from many of Woodward's worldwide locations, depending upon the product and application. This service can assist you with technical questions or problem solving during the normal business hours of the Woodward location you contact. Emergency assistance is also available during non-business hours by phoning Woodward and stating the urgency of your problem.

Product Training is available as standard classes at many of our worldwide locations. We also offer customized classes, which can be tailored to your needs and can be held at one of our locations or at your site. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability.

Field Service engineering on-site support is available, depending on the product and location, from many of our worldwide locations or from one of our Full-Service Distributors. The field engineers are experienced both on Woodward products as well as on much of the non-Woodward equipment with which our products interface.

For information on these services, please contact us via telephone, email us, or use our website and reference **www.woodward.com/support**, and then *Customer Support*.

How to Contact Woodward

For assistance, call one of the following Woodward facilities to obtain the address and phone number of the facility nearest your location where you will be able to get information and service.

Electrical Power Systems	Engine Systems	Turbine Systems
Facility --------------- Phone Number	**Facility --------------- Phone Number**	**Facility --------------- Phone Number**
Australia----------- +61 (2) 9758 2322	Australia----------- +61 (2) 9758 2322	Australia----------- +61 (2) 9758 2322
Brazil ------------- +55 (19) 3708 4800	Brazil ------------- +55 (19) 3708 4800	Brazil ------------- +55 (19) 3708 4800
China------------+86 (512) 6762 6727	China------------+86 (512) 6762 6727	China------------+86 (512) 6762 6727
Germany:	Germany:	
Kempen --- +49 (0) 21 52 14 51		
Stuttgart -----+49 (711) 78954-0	Stuttgart -----+49 (711) 78954-0	
India --------------- +91 (129) 4097100	India --------------- +91 (129) 4097100	India --------------- +91 (129) 4097100
Japan --------------+81 (43) 213-2191	Japan --------------+81 (43) 213-2191	Japan --------------+81 (43) 213-2191
Korea---------------+82 (51) 636-7080	Korea---------------+82 (51) 636-7080	Korea---------------+82 (51) 636-7080
	The Netherlands -+31 (23) 5661111	The Netherlands -+31 (23) 5661111
Poland -------------- +48 12 618 92 00		
United States-----+1 (970) 482-5811	United States-----+1 (970) 482-5811	United States-----+1 (970) 482-5811

You can also contact the Woodward Customer Service Department or consult our worldwide directory on Woodward's website (**www.woodward.com/support**) for the name of your nearest Woodward distributor or service facility.

For the most current product support and contact information, please refer to the latest version of publication **51337** at **www.woodward.com/publications**.

Technical Assistance

If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

General
Your Name_____
Site Location_____
Phone Number_____
Fax Number_____

Prime Mover Information
Engine/Turbine Model Number_____
Manufacturer_____
Number of Cylinders (if applicable)_____
Type of Fuel (gas, gaseous, steam, etc)_____
Rating_____
Application_____

Control/Governor Information
Please list all Woodward governors, actuators, and electronic controls in your system:

Woodward Part Number and Revision Letter

Control Description or Governor Type

Serial Number _____

Woodward Part Number and Revision Letter

Control Description or Governor Type

Serial Number _____

Woodward Part Number and Revision Letter

Control Description or Governor Type

Serial Number _____

If you have an electronic or programmable control, please have the adjustment setting positions or the menu settings written down and with you at the time of the call.

DECLARATION OF CONFORMITY
According to EN 45014

Manufacturer's Name: WOODWARD GOVERNOR COMPANY (WGC)
Industrial Controls Group

Manufacturer's Address: 1000 E. Drake Rd.
Fort Collins, CO, USA, 80525

Model Name(s)/Number(s): TecJet 50 Plus and TecJet 110
8407-513, 8407-514, 8407-515 and similar

Conformance to Directive(s): 89/336/EEC COUNCIL DIRECTIVE of 03 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility as amended by 92/31/EEC and 93/68/EEC.

Applicable Standards: EN 61000-6-4, October 2001: EMC Part 6-4: Generic Standards – Emission Standard for Industrial Environments
EN 61000-6-2, October 2001: EMC Part 6-2: Generic Standards - Immunity for Industrial Environments

We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER

_____
Signature

Douglas Salter
_____
Full Name

Engineering Manager
_____
Position

WIC, Fort Collins, CO, USA
_____
Place

12/20/02
_____
Date

Declaration of Incorporation

Woodward Governor Company
1000 E. Drake Road
Fort Collins, Colorado 80525
United States of America

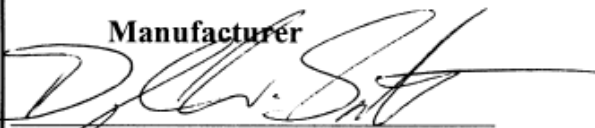**Product: TecJet 50 Plus and TecJet 110**
Part Number: 8407-513, 8407-514, 8407-515 and similar

The undersigned hereby declares, on behalf of Woodward Governor Company of Loveland and Fort Collins, Colorado, that the above-referenced product is in conformity with the following EU Directives as they apply to a component:

98/37/EEC (Machinery)

This product is intended to be put into service only upon incorporation into an apparatus/system that itself will meet the requirements of the above Directives and bears the CE mark.

Manufacturer

_____
Signature

Douglas W. Salter
Full Name

Engineering Manager
Position

WGC, Fort Collins, CO, USA
Location

12/16/02
Date

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 26219G.

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