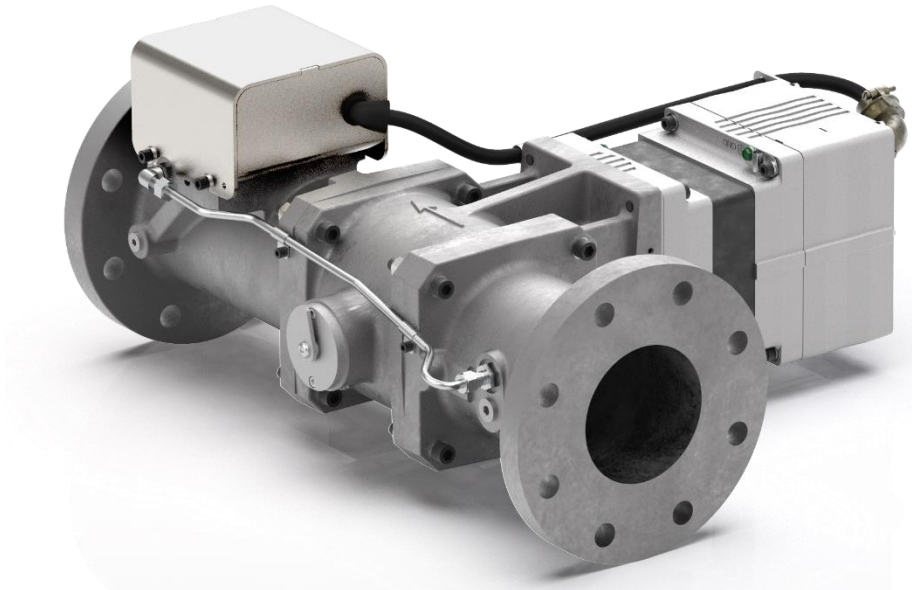
WOODWARD

Product Manual 26185
(Revision M, 09/2022)
Original Instructions



TecJet™ 110

Installation and Operation Manual

General Precautions

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.

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, on the *publications page* of the Woodward website:

http://www.woodward.com

The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

Proper Use

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.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26455*, *Customer Publication Cross Reference and Revision Status & Distribution Restrictions*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Revisions— A bold, black line alongside the text identifies changes in this publication since the last revision.

Manual 26185

Contents

Illustrations and Tables

Warnings and Notices

Important Definitions

This is the safety alert symbol 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

Lockout/Tagout LOTO

Ensure that personnel are fully trained on LOTO procedures prior to attempting to replace or service a TecJet on a "live" running engine. All safety protective systems (overspeed, over temperature, overpressure, etc.) must be in proper operational condition prior to the start or operation of a running engine. Personnel should be equipped with appropriate personal protective equipment to minimize the potential for injury due to release of hot hydraulic fluids, exposure to hot surfaces and/or moving parts, or any moving parts that may be activated and are located in the area of control of the TecJet.

⚠WARNING

Overspeed / Overtemperature / Overpressure

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.

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

WARNING

Automotive Applications

On- and Off-Highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

WARNING

IOLOCK

IOLOCK: driving I/O into a known state condition. When a control fails to have all the conditions for normal operation, watchdog logic drives it into an IOLOCK condition where all output circuits and signals will default to their de-energized state as described below. *The system MUST be applied such that IOLOCK and power OFF states will result in a SAFE condition of the controlled device.*

- **Microprocessor failures will send the module into an IOLOCK state.**
- **Discrete outputs / relay drivers will be non-active and de-energized.**
- **Analog and actuator outputs will be non-active and de-energized with zero voltage or zero current.**

Network connections like CAN stay active during IOLOCK. This is up to the application to drive actuators controlled over network into a safe state.

The IOLOCK state is asserted under various conditions, including:

- **Watchdog detected failures**
- **Microprocessor failure**
- **PowerUp and PowerDown conditions**
- **System reset and hardware/software initialization**
- **PC tool initiated**

NOTE—Additional watchdog details and any exceptions to these failure states are specified in the related section of the product manual.

NOTICE

Battery Charging Device

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.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

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*.

Follow these precautions when working with or near the control.

1. 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.
2. Touch your finger to a grounded surface to discharge any potential before touching the control, smart valve, or valve driver, or installing cabling connectors. Alternatively, ESD mitigation may be used as well: ESD smocks, ankle or wrist straps and discharging to a reference grounds surface like chassis or earth are examples of ESD mitigation.
    - ESD build up can be substantial in some environments: the unit has been designed for immunity deemed to be satisfactory for most environments. ESD levels are extremely variable and, in some situations, may exceed the level of robustness designed into the control. Follow all ESD precautions when handling the unit or any electronics.
        - I/O pins within connectors have had ESD testing to a significant level of immunity to ESD, however do not touch these pins if it can be avoided.
            - Discharge yourself after picking up the cable harness before installing it as a precaution.
        - The unit is capable of not being damaged or improper operation when installed to a level of ESD immunity for most installation as described in the EMC specifications. Mitigation is needed beyond these specification levels.

IMPORTANT

External wiring connections for reverse-acting controls are identical to those for direct-acting controls.

Regulatory Compliance

European Compliance for CE Marking:
These listings apply to stationary industrial markets only and are limited only to those units bearing the CE Marking.

EMC Directive: Declared to Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC).

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

Machinery Directive: Compliant as partly completed machinery with Directive 2006/42/EC of the European Parliament and the Council of 17 May 2006 on machinery.

Pressure Equipment Directive: Compliant as “SEP” per Article 4.3 to Pressure Equipment Directive 2014/68/EU on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment.

RoHS Directive: Restriction of Hazardous Substances 2011/65/EU:
This product is intended to be sold and used only as equipment which is specifically designed, and is to be installed, as part of another type of equipment that is excluded or does not fall within the scope of this Directive, which can fulfil its function only if it is part of that equipment, and which can be replaced only by the same specifically designed equipment and therefore fulfills the requirements stated in Art.2.4(c) and as such is excluded from the scope of the Directive.

Restriction of Hazardous Substances 2011/65/EU:
This product is intended to be sold and used only as repair, updating, or upgrading of EEE (as defined in Article 3(27) of the Directive) that either was excluded from the scope of the Directive at the time of placing on the market (as defined in Article 4.4(e)) or which benefited from an exemption, and which was placed on the market before that exemption expired (per Article 4.4(f).

United Kingdom Compliance for UKCA Marking:
These listings are limited only to those units bearing the UKCA Marking.

EMC: S.I. 2016 No. 1091: Electromagnetic Compatibility Regulations 2016 and all applicable amendments.

Other UKCA Compliance:
Compliance with the following UKCA regulations or standards does not qualify this product for application of the UKCA Marking:

Machinery: S.I. 2008 No. 1597: Supply of Machinery (Safety) Regulations 2008

Pressure Equipment (Safety) Regulations 2016: S.I. 2016 No. 1105: Compliant to sound engineering practice per Regulation 8

Hazardous Substances and Packaging: S.I. 2020 No. 1647: The Hazardous Substances and Packaging (Legislative Functions and Amendments) (EU Exit) Regulations 2020

This product is intended to be sold and used only as equipment which is specifically designed, and is to be installed, as part of another type of

equipment that is excluded or does not fall within the scope of this Regulation, which can fulfil its function only if it is part of that equipment, and which can be replaced only by the same specifically designed equipment and therefore fulfills the requirements stated in Part 2 of Schedule1 clause 16 and as such is excluded from the scope of the Regulation.

This product is intended to be sold and used only as repair, updating or upgrading of EEE (as defined in part 3 of schedule 1) that either was excluded from the scope of the Directive at the time of placing on the market (as defined in Schedule 1, part 2) or which benefited from an exemption, and which was placed on the market before that exemption expired (per schedule 1 part 3).

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
Type 3R Enclosure Rainproof

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 110 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.

Special Conditions for Safe Use:

The TecJet 110 wiring must be in accordance with North American Class I, Division 2, or European or other international Zone 2, Category 3 wiring methods as applicable, and in accordance with the authority having jurisdiction.

Field wiring must be suitable for at least 85° C.

Connect ground terminal of TecJet 110 to earth ground.

The Ingress Protection rating of the control depends on the use of proper mating connectors. Refer to Table 2-1 in the Installation section of this manual for information on the proper mating connectors for use with this control.

Compliance with the Machinery Directive 2006/42/EC noise measurement and mitigation requirements is the responsibility of the manufacturer of the machinery into which this product is incorporated.

⚠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.

Do not clean equipment unless 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.

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2 ou Zone 2.

Ne pas nettoyer l'équipement à moins de se trouver dans un emplacement non dangereux.

⚠ 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 2-3.

Chapter 1.
General Information

Introduction

The TecJet 110 product 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 which monitor fuel pressure, temperature, and valve pressure differential. Based on these sensor signals, the device calculates and controls the valve position needed to produce a physical fuel mass flow which matches the demanded fuel flow within the accuracy specified elsewhere in this manual.

The TecJet 110 actuator includes closed-loop position control based on an internal position sensor and the calculated position setpoint. Model-based position controller software is used to position the valve.

This manual covers the TecJet 110 Fuel Metering Valves.

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

IMPORTANT **Throughout the remainder of the manual, the TecJet 110 valve and actuator system will be referred to simply as the TecJet 110.**

Connections to the TecJet 110

The TecJet 110 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 110
Key Switch input	Contact input to switch the TecJet 110 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 110 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 110 provides RS-232 serial communications connections in the main connector for program upgrades and Service Tool interfacing by qualified service personnel.

Programmable Features

Control setup is accomplished using a Windows-based PC (personal computer) and Woodward Service Tool software. The TecJet 110 is provided pre-configured with default settings and may not require additional setup. The features identified below are described in Chapter 5. Briefly, the programmable features include:

- **Configure Demand Source**
  - Jenbacher CAN (Proprietary protocol)
  - Analog 4–20
  - PWM
  - EGS-01 (Proprietary protocol)
  - GECM (Proprietary protocol)
  - EGS-02 (SAE J1939 protocol)
  - CANopen
  - CANopen PWM
- **Configure General**
  - Fuel Gas Defaults (K, Density)
  - Fuel Gas Temperature Warning Thresholds (High & Low °C)
  - Fuel Gas Pressure Warning Thresholds (High & Low mbar)
  - ΔP Warning Threshold (High & Low ΔP mbar)
- **Configure Flow (Demand Source Dependent)**
  - Demand Fail Limits (ms, mA, or %)
  - Scaling (High & Low mA or Duty Cycle % to Nl/s Flow)
- **Configure Failed Sensor Defaults**
  - Fuel Gas Temperature Sensor Default Temperature (°C)
  - Fuel Gas Pressure Sensor Default Downstream pressure (Table)
- **Configure Filters**
  - ΔP Filter Time Constant (sec)
  - Fuel Gas Pressure Filter Time Constant (sec)
  - Fuel Gas Temperature Filter Time Constant (sec)
  - Flow Demand Filter Time Constant (sec)
- **Configure CAN (Demand Source Dependent)**
  - Baud Rate Default (kbits/s)
  - Baud Rate User Configured
    - Baud Rate Prescaler:
    - TSEG1
    - TSEG2
    - Synchronization Jump Width
  - Heartbeat Rate
  - CAN Identifiers

Service Tool Software

The TecJet Service Tool software is a Microsoft Windows based GUI (graphic user interface) used to configure and troubleshoot the TecJet 110. The Service Tool Software is compatible with Microsoft Windows 10, 7, and XP and gives the end user the ability to:

- Configure control settings based on application requirements
- Load the configuration into the control
- Monitor control parameters
- View and reset fault conditions

Detailed descriptions of software installation are available in Chapter 5.

Chapter 2.
Installation

Introduction

IMPORTANT

The TecJet 110 is designed for use in industrial stationary applications only.

WARNING

Overspeed
Overtemperature
Overpressure

The engine should be equipped with an independent fuel shut-off device to protect against fuel leakage or damage to the engine with possible personal injury, loss of life, or property damage.

The fuel shut off device must be totally independent of the engine control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

WARNING

Due to typical noise levels in engine environments, hearing protection should be worn when working on or around the TecJet 110.

WARNING

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.

WARNING

Do not lift or handle the TecJet 110 by any conduit or wiring harness.

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.

WARNING

The TecJet 110 valve is pressure tested at Woodward. Allowable leakage is less than 2 SCCM or 0.00015 kg/h.

WARNING

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

WARNING

The TecJet 110 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™ 110 valve weighs 31 kg (68 lb). To prevent injury, some form of lifting assistance (a lifting strap is recommended) should be used when handling the TecJet 110.

⚠CAUTION **This valve has a high torque capability and sharp elements. To prevent serious injury, DO NOT place hands or fingers or any object inside the valve.**

Be careful when unpacking the TecJet 110. 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 110 on the valve position pointer or the actuator electrical connectors. Notify the shipper and Woodward if damage is found.

If the TecJet 110 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 110 orientation and mounting must be designed to reduce the possibility of fuel contamination, pooling, or build-up within the pressure sensor passages. Orientation of the valve should be with the actuator +15/–90° 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. Consider the strength of the mounting plate to support the 31 kg (68 lb) weight of the TecJet 110. Refer to the outline drawing in Figure 2-1 for dimensions and details relative to the valve inlet flange and outlet flange.

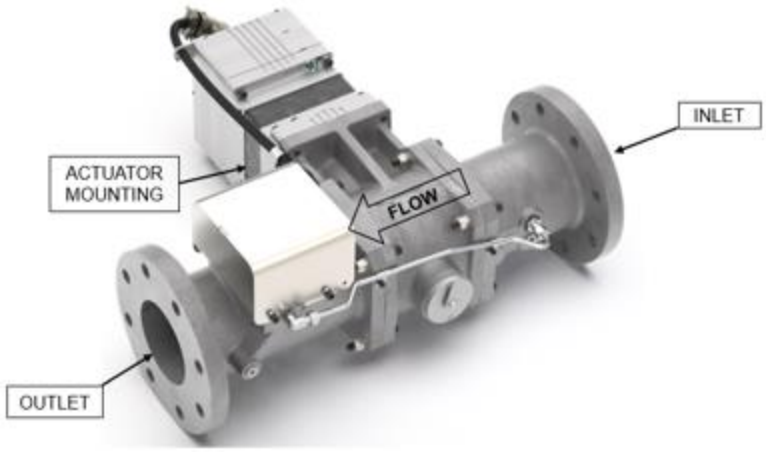


Figure 2-1a. TecJet 110 Overview

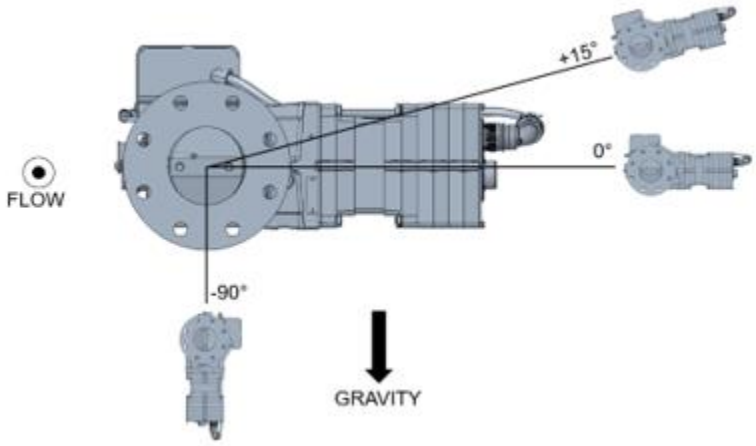


Figure 2-1b. Allowable Actuator Orientations

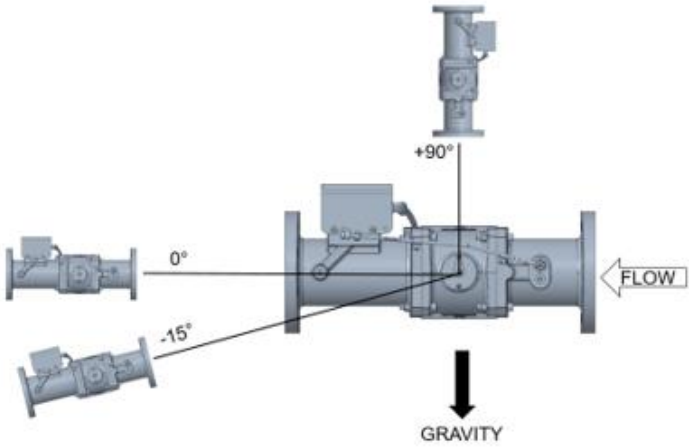


Figure 2-1c. Allowable Bore Orientations

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 for the actuator mounting hole and hole-location details. Torque the four M8 fasteners attaching the actuator to a bracket to 22.6 N·m (200 lb-in). 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.

⚠WARNING

The TecJet 110 is not intended to support the inlet or outlet piping. Suitable brackets must be constructed to support the actuator, valve and piping separately to prevent damage to the TecJet.

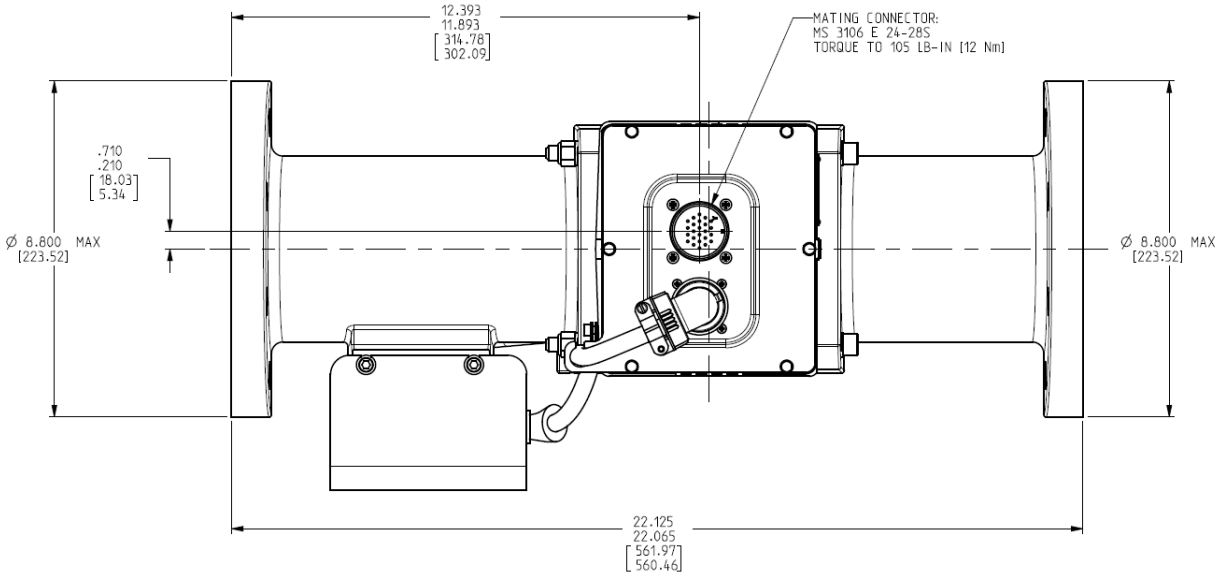
The inlet and outlet piping of the TecJet 110 must be in accordance with ANSI/ISA-S75.02 to ensure the flow metering accuracy specified elsewhere in this manual. However, an inlet piping length as short as 6 diameters and an outlet piping length as short as 2 diameters can typically be used with a negligible loss in valve metering accuracy.

⚠WARNING

EXPLOSION HAZARD—Leak check all gaseous fuel connections. Leaking gaseous fuel can cause explosion hazards, property damage, or loss of life.

Outline Drawings

Reference Woodward drawing 9999-1733 Rev New.



NOTES:

1. INTERPRET DRAWING PER ASME Y14.5-2009.
2. A MINIMUM GAP OF .020 [0.5] MUST BE MAINTAINED AROUND THE ELECTRONICS ENCLOSURE AND ANY MOUNTING SURFACE AFTER INSTALLATION PER MANUAL.
3. WEIGHT APPROXIMATELY 68 LBS (31 KG)
4. DIMENSIONS ARE SHOWN AS INCHES [MILLIMETERS].

Figure 2-2a. Actuator Connector View

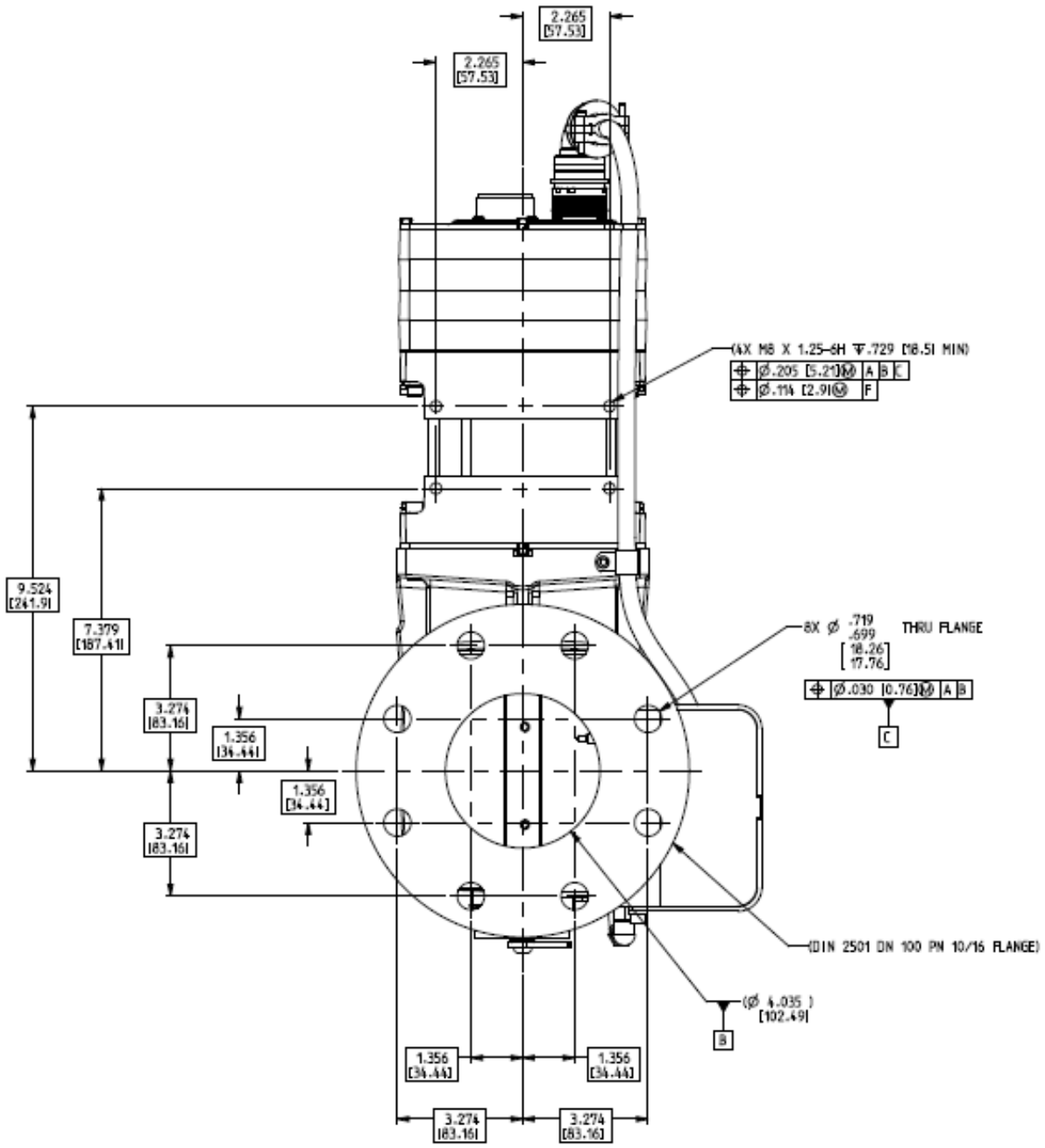


Figure 2-2b. Valve Outlet Flange and Actuator Mounting View

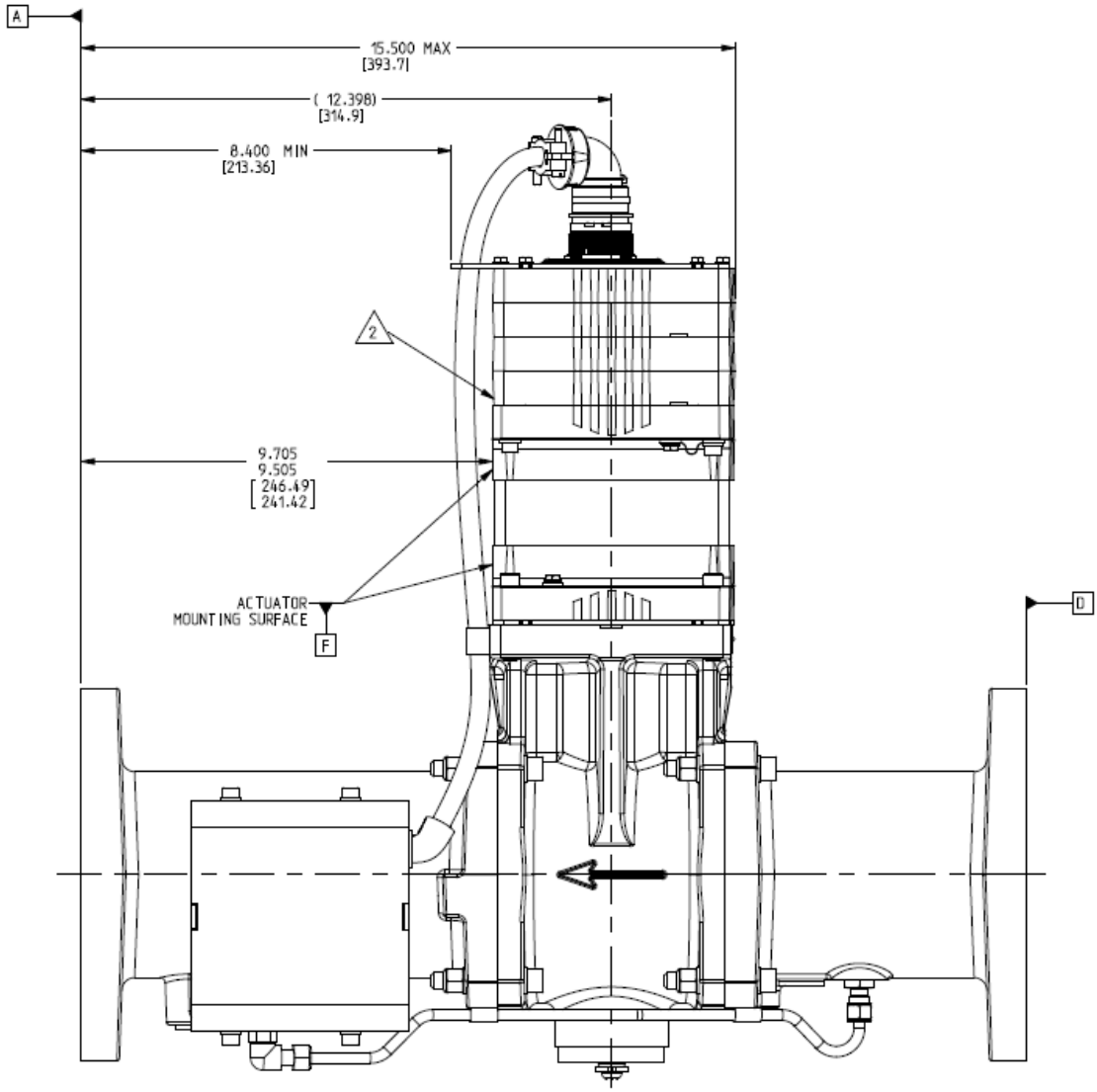


Figure 2-2c. Valve Outlet to Actuator Mounting View

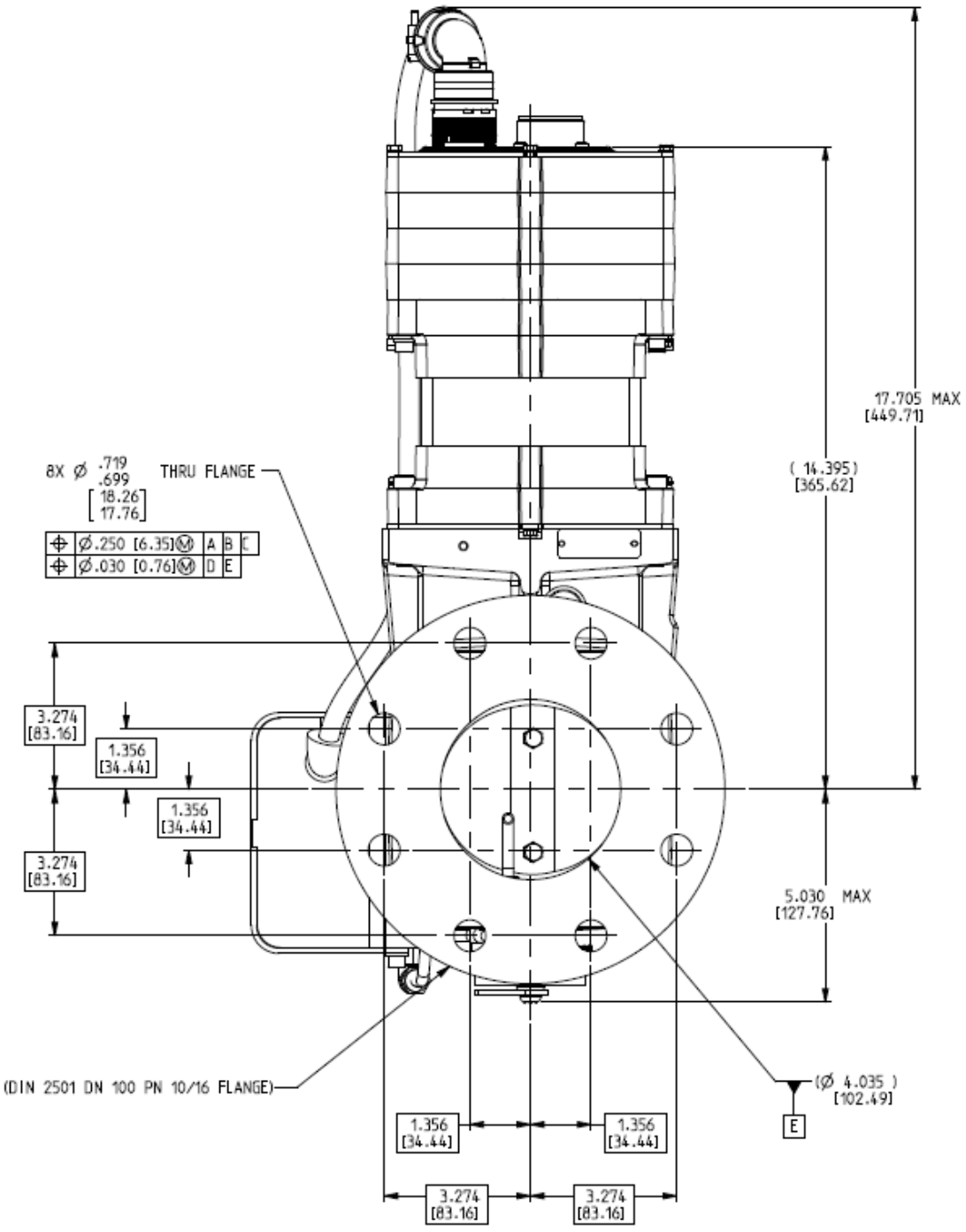


Figure 2-2d. Valve Inlet View

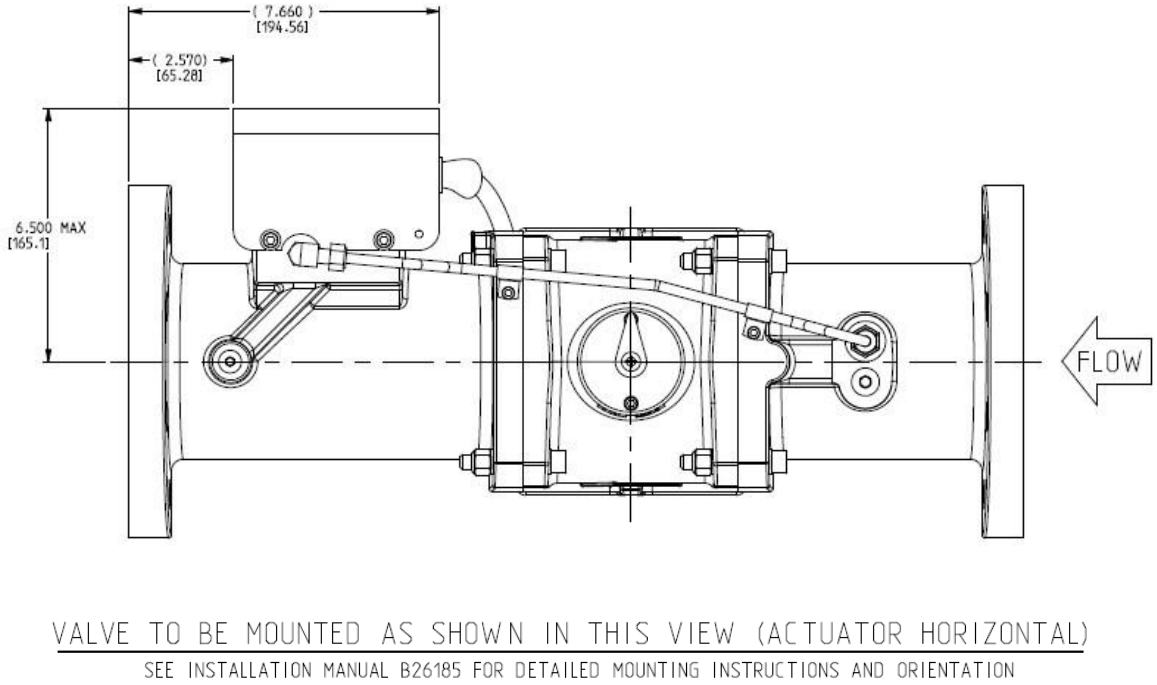


Figure 2-2e. Preferred Valve Mounting with Actuator Positioned Horizontally

Electrical Connections

The TecJet 110 is electrically connected to the control system (ECM) by the main connector shown in Figure 2-2. The mating connector should be torqued per the value indicated in Figure 2-2. The following mating connectors are compatible with the TecJet 110 control.

Table 2-1. Mating Connector

Supplier	Part Number
Amphenol	Amphenol Connector: P/N ACC 06E 24-28S (025) Amphenol Contacts: P/N 10-597109-171 (CRIMP) Amphenol Sealing Plugs P/N 10-405996-16
Cannon	Cannon Connector: P/N CA 06R 24-28S A206 Cannon Contacts: P/N 031-0560-161 (CRIMP) Cannon Sealing Plugs: P/N 225-0017-000
Woodward	Connector Kit: P/N 6995-1021 (Connector, Contacts, Sealing Plugs)

⚠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.

Do not clean equipment unless 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.

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2.

Ne pas nettoyer l'équipement à moins de se trouver dans un emplacement non dangereux.

⚠WARNING

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

⚠WARNING

The control will only meet ingress protection specifications while the mating connector is installed in the unit. As such, the unit should not be exposed to operating environments unless the mating connector is installed.

In addition, if a wire is not used for each of the 24 pins on the control, a sealing plug must be used in place of each missing wire. Failure to adhere to these guidelines may result in product failure or decreased life.

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 2-3.

Shielded Wiring

The use of cable with individually shielded-twisted pairs is only required where indicated by the control wiring diagrams (Figure 2-3). Cable shields must be terminated as indicated in the control wiring diagram using the installation notes described below. DO NOT attempt to directly ground the shield at both ends since an undesired ground loop condition may occur. For the TecJet 110 CAN shield connection, this pin is connected to ground through a high frequency capacitor only (not directly grounded), so in this case the shield may be grounded at the other end of the network also.

Installation Notes

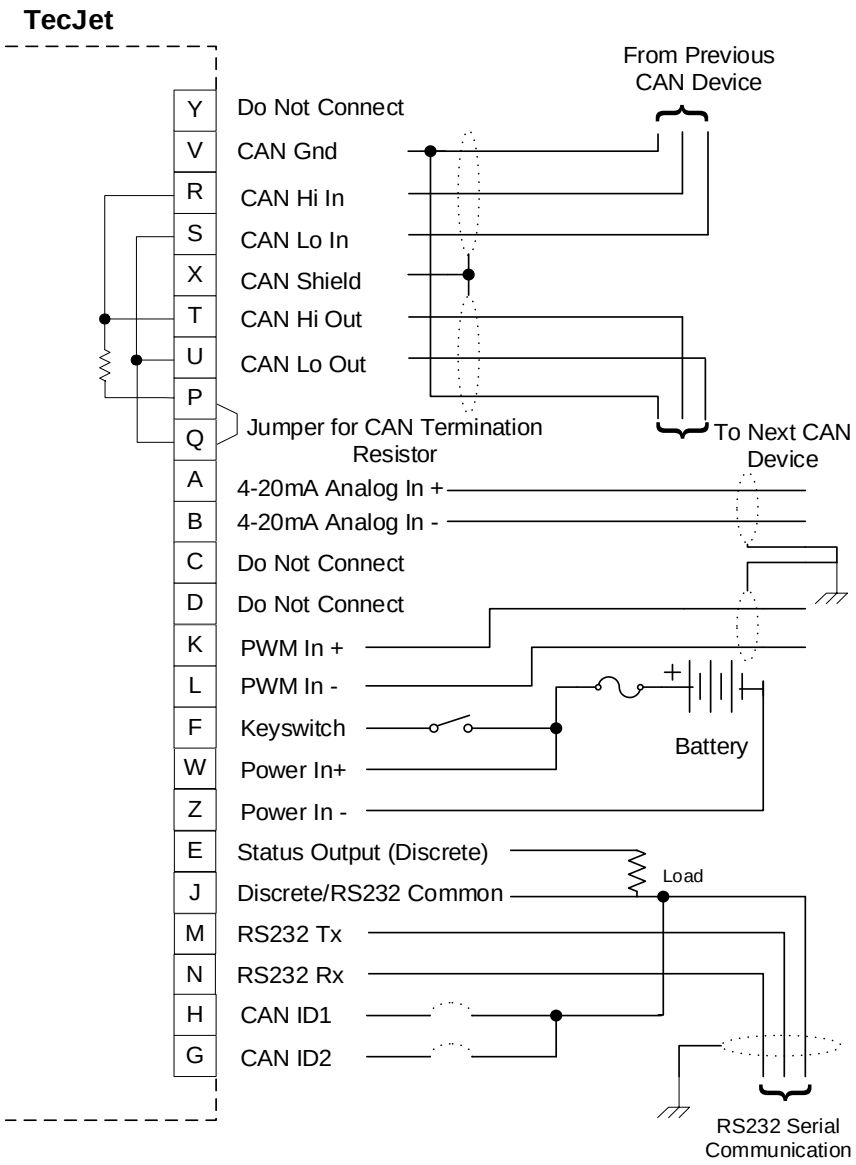
- Wires exposed beyond the shield should be as short as possible, not exceeding 50 mm (2 inches).
- The shield termination wire (or drain wire) should be kept as short as possible, not exceeding 50 mm (2 inches), and where possible the diameter should be maximized.
- Installations with severe electromagnetic 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, when provided, at the time of installation is recommended to assure satisfactory operation of the product.

Earth Ground

Ground Lug = Earth Ground

To ensure CE compliance and proper EMC performance, the TecJet must be grounded to the engine structure through a low impedance connection. This may be accomplished through the mechanical mounting of the valve itself (preferred), or through a wired connection to the designated ground screw on the unit. If a wired connection is used as the primary EMC ground, it must be through a low impedance wire or strap < 30 cm (12 inches) in length and at least 3.3 mm² (12 AWG) in size.



The recommended wire size for W and Z (Power Supply Inputs) is at least 1.3 mm² (16 AWG). For all other I/O, the recommended wire size is at least 0.5 mm² (20 AWG).

Figure 2-3. TecJet 110 Valve Wiring Diagram

IMPORTANT

Except for the CAN communication lines, all signal and I/O wiring on the TecJet 110 must not to exceed 30 m (100 ft) in length. See "Supply Voltage" section for specific wire length limitations on the power supply inputs.

IMPORTANT

When wiring to pin J on the TecJet 110, be careful to ensure that the external circuit interface is isolated from battery ground, either by means of galvanic isolation or differential input/output.

If it is not, a ground loop could be formed that can cause excess noise on the lines and/or damage to circuits.

Supply Voltage

W = Power-In (+)
Z = Power-In (–)

The supply voltage during normal operation must be 18 to 32 V, measured at the TecJet 110 connector. Steady state input current can reach 4.0 A, and transient input current may reach up to 13.0 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 15 A fast blow fuse**.

Recommended maximum wire length from power source to TecJet 110 valve based on an 18 V Power Supply: **16 AWG (1.3 mm²)—8 m (26 ft*)**

Recommended maximum wire length from power source to TecJet 110 valve based on a 24V Power Supply: **16 AWG (1.3 mm²)—13 m (43 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.

Keyswitch

F = Keyswitch

The keyswitch is not active in all TecJet configurations. The keyswitch is used to switch the TecJet 110 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.

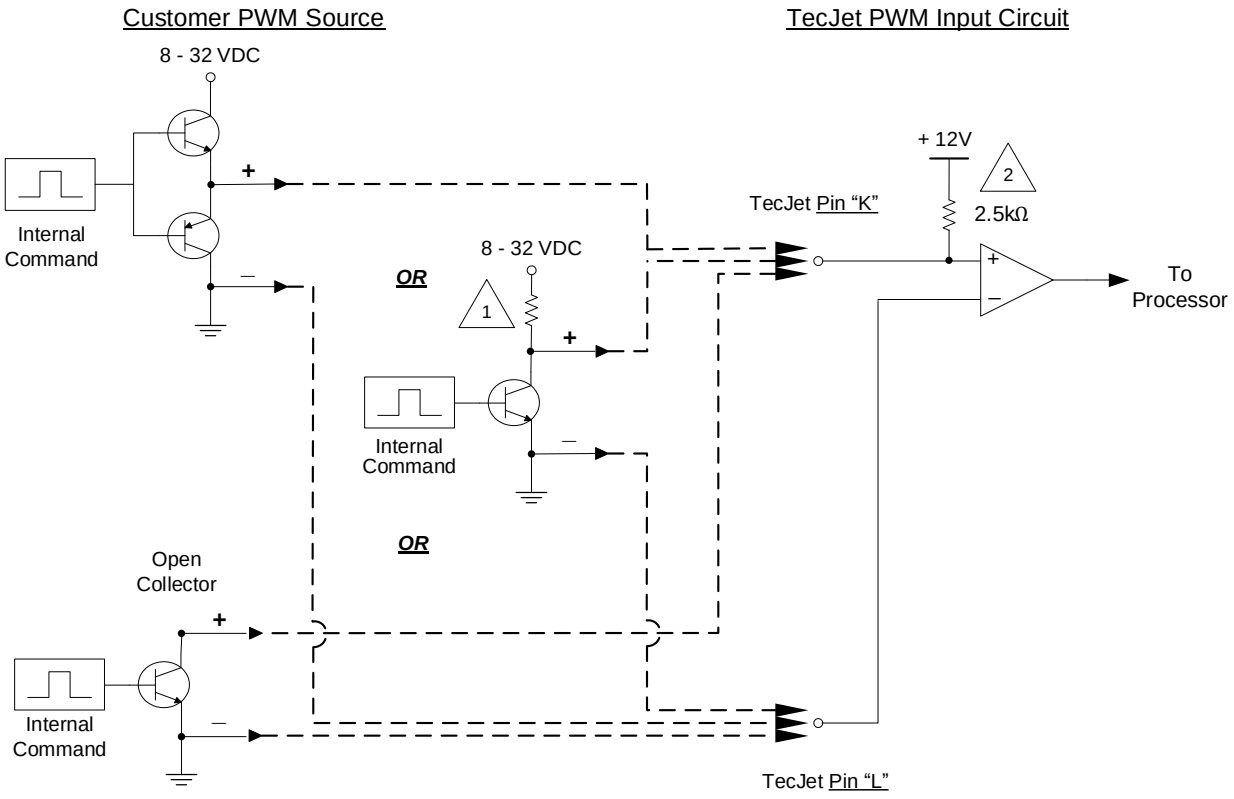
PWM Input

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.

Table 2-2. PWM Input Specifications

Input Magnitude	8–32 V differential input
Input Impedance	40 kΩ
Input Type	Differential input
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
PWM Detection Threshold	7.3 V nominal



NOTES:

1. This resistor is supplied by the customer to complete the push-pull source externally. It is NOT internal to the TecJet valve.

2. This resistor is present in all TecJet valves. It must be taken into consideration when selecting an external pull-up or pull-down resistor to ensure that the PWM signal passes through the detection threshold.

Figure 2-4. TecJet 110 PWM Wiring

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 110 is used on an engine. If one TecJet 110 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.

Table 2-3. CAN ID Code Definitions

TecJet 110 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 110 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 110 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 110 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). TecJet 110 CAN is isolated. No wiring is to exceed 30 meters in length.

Table 2-4. CAN ID Specifications

Voltage Level	5 V
Isolation	1000 Vrms (optically decoupled)
Type	The TecJet 110 valve supports CAN 2.0B
Baud Rate	Configurable from 250 K to 1 Meg

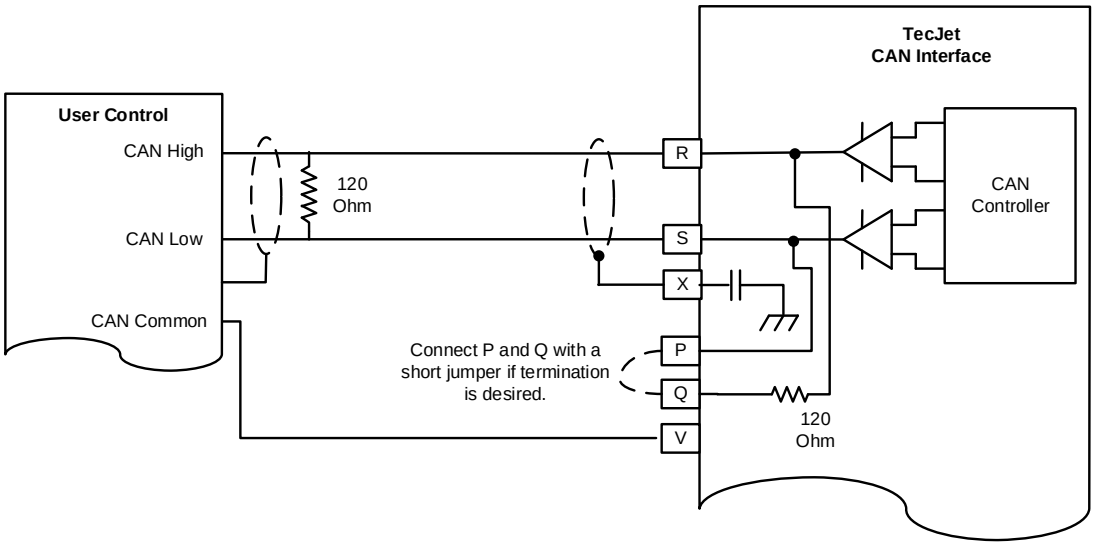


Figure 2-5. TecJet 110 CAN Wiring for Non-isolated Systems

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 than one TecJet 110 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 110 input pins.

WARNING

If a second device is connected to the CAN output pins, this device will lose communication if the TecJet 110 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 110 case through a capacitor.

4-20mA 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.

Table 2-5. 4–20 mA Analog Input Specifications

Input Impedance	225 Ω
Input Type	4–20 mA differential
Max Input Current	25 mA ±2%
Accuracy	±1.5% of full scale @ 25 °C
Temperature Drift	300ppm/°C
Input Common Mode Range	At least ±50 V
Common Mode Rejection Ratio	-60 dB minimum
Safe Input Common Mode Voltage	At least ±200 V
PWM Detection Threshold	7.3 V nominal

Status Output

E = Status Output
J = Discrete/RS232 Common

The status output indicates whether the TecJet 110 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".

Table 2-6. Status Output Specifications

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 110 valve.

Table 2-7. RS-232 Service Port Specifications

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 110 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 5 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 1.1 N·m (0.8 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 110 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 110 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 110 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 110 system fail. An independent fuel shutoff device should also be used to shut off fuel flow in case the TecJet 110 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. Below is a summary of diagnostic events.

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 6 (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 110 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 110 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 110 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.

Temperature Sensing

The TecJet 110 actuator monitors board temperature with on-board temperature sensors to protect the unit from over-temperature. Electronics Temperature High or Low warning is annunciated when temperatures greater than 150 °C or less than –50 °C are detected respectively. These threshold settings are fixed and not configurable.

Current Limiting Based on Temperature

The controller provides actuator current limiting based on the electronics temperature. Dependent on board and actuator thermal models, the software reduces current as necessary to avoid conditions that would damage the unit due to extreme temperatures.

Current limiting based on temperature begins when the combined current and temperature environment causes board temperatures greater than 100 °C. The limit curve is a linear de-rate from full current at 100 °C down to zero current at 140 °C. Depending on the current (actuator torque) and ambient operating temperatures, the unit may never reach the current limiting state.

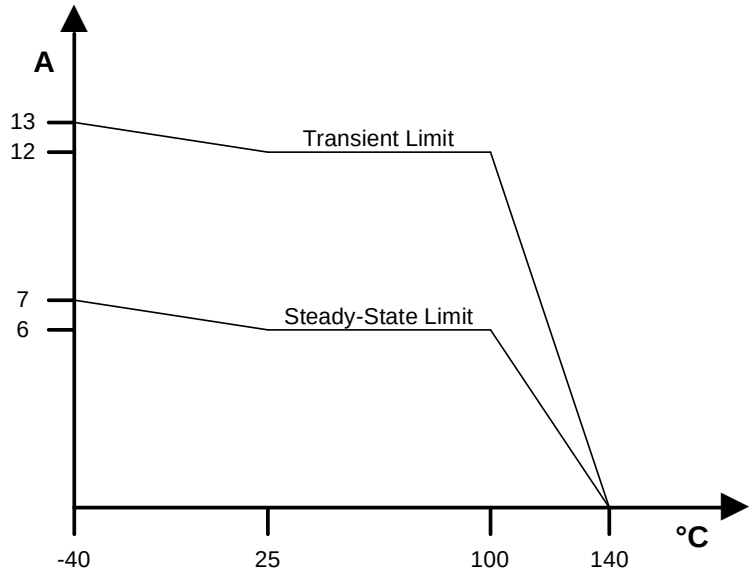


Figure 3-1. Current Limiting Based on Temperature

CANopen Communications

The TecJet 110 supports 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, or 1000 kbps. 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.

Table 3-1. Transmit PDO

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

Table 3-2. Receive PDOs

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: 99 ms
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.

Table 3-3. PDO Summary

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 supports 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 110)
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 110 ➔ 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 110 ➔ 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 110 ➔ 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 110 ➔ 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 110 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 110 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 110 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.

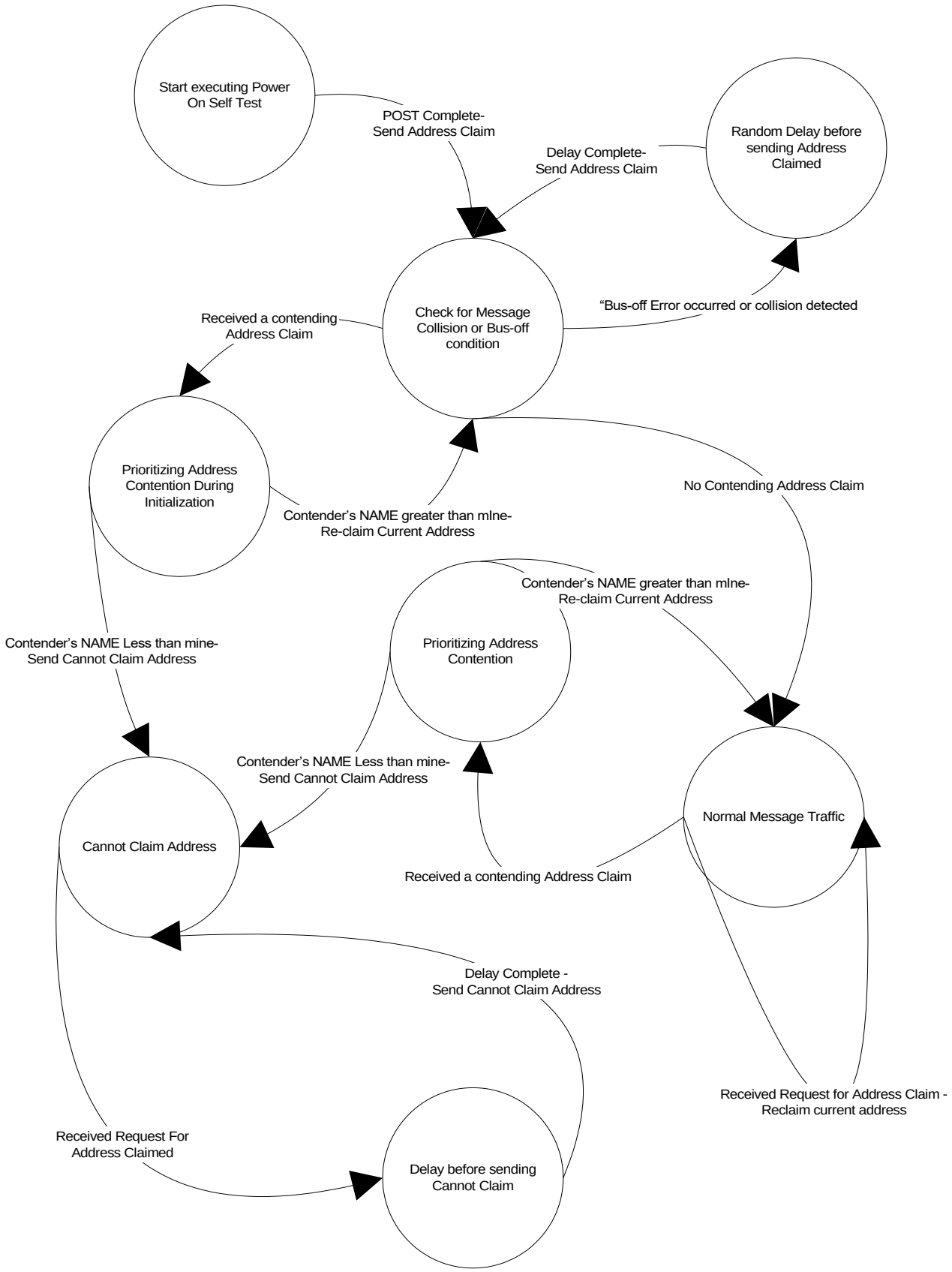


Figure 3-2. Address Claimed State Chart

Cannot Claim Address

The Cannot Claim Address message will be sent out if the TecJet 110 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 110 cannot claim an Address a status bit will be set and the valve will shut down.

TecJet 110 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 has 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.

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.

TecJet 110 Specifications

General Specifications

Table 3-4. General Specifications

Electrical Input Characteristics	
Input Voltage Range	18–32 Vdc
Maximum Steady State Input Current	4 A
Maximum Transient Input Current	13 A
Mechanical Characteristics	
Valve Maximum Effective Area	6065 mm² (9.4 in²)
Valve Minimum Effective Area	65 mm² (0.1 in²) See section on valve sizing for detailed information
Weight	68 lbs (31 kg)
Mounting	See installation drawings (Figure 2-1)
Fuel Connections	
Filter Requirements	Less than 50.0 µm See outline drawings for additional details.
Dynamics	
Position Response	Bandwidth at ±0.5% amplitude ≥ 5 Hz at –6 db (24 V supply) Bandwidth at ±2% amplitude ≥ 6 Hz at –3 db (24 V supply)
Step Response Slew Time	< 80 ms on large steps measured 10% to 90% of the demanded step (24V supply)
Overshoot	< 2% of the step
Demanded Flow Response	Flow demand to position demand has latency of < 4.5 ms
Pressure Change Rejection	Same as demanded flow response with additional allowance for a 10 msec sensor lag, 2.4 msec anti-aliasing lag, and 3.6 msec dead time (1.5*2.4 msec slow rate group)

Environmental Specifications

Table 3-5. Environmental Specifications

Temperature:	
Steady State Ambient Temperature	–20 to +85 °C (–4 to 185 °F)*
Steady State Case Temperature	–20 to +90 °C (–4 to +194 °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 85 °C (32 to 149 °F)
Vibration and Shock:	
Random Vibration ǂ	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)
Ingress Protection	IP56 per IEC 60529, (Dust ingress, water ingress)
EMC	EN61000-6-2 (2005): Immunity for Industrial Environments EN61000-6-4 (2001): Emissions for Industrial Environments

(*) 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.

(ǂ) It is recommended that engine vibration data for each new application be evaluated to ensure that TecJet test levels are adequate. Contact Woodward engineering for further details.

Fuel Specifications

The TecJet 110 fuel metering valve is designed to operate primarily on specialty gas such as landfill, digester, or other biogases. The valve is also compatible with normal pipeline quality natural gas. Proper application of the valve for fuel flow, pressure, energy content, etc. is the responsibility of the OEM/packager/customer. The fuel gas flowing through the valve can consist of the components and limits indicated in the table below.

Table 3-6. Fuel Gas Compounds

Component	Specification
Gaseous Hydrocarbons (methane, ethane, propane, etc.)	No limit
Carbon Monoxide	No limit
Carbon Dioxide	No limit
Hydrogen	< 10% (< 30%)
Oxygen	No limit
Nitrogen	No limit
Sulfur Compounds including Hydrogen Sulfide	< 650 ppm (< 2600 ppm)
Chlorine and Fluorine Compounds (typically chlorofluorocarbons)	< 130 ppm (< 520 ppm)
Silicon	< 7 ppm (< 25 ppm)
Ammonia	< 65 ppm
Oil or Hydrocarbons in Liquid (mist form)	< 7 ppm
Fine Particulates, including Silicon (less than 1.0 µm)	< 4 ppm

The gas specific gravity should be between 0.4 to 2.0 and energy content 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 from ppm to mg/10kWh by multiplying the ppm value by 36 and dividing by the LHV of the gas in MJ/kg.

TecJet valves running in mine gas or coke gas applications may need to be periodically internally cleaned per the cleaning procedure described later in this manual.

Pressures

Inlet fuel gas pressure (FGP) should normally be between 876 and 1289 mbar absolute. The valve is sized to provide rated flow specified in this specification for operation from 0 to 1500 m. Above this altitude the flow capacity will be reduced with decreasing absolute FGP. 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. Fuel gas pressure should not exceed 1565 mbar.

Fuel gas differential pressure (delta-p) should be between 30 and 275 mbar. Delta-p below this range is allowed during cranking and idle conditions, but accuracy of the valve will be reduced. For delta-p below 69 mbar or above 275 mbar, flow accuracy will also decrease, and a reduction in valve stability may occur above 200 mbar. Refer to the Accuracy section later in this chapter for further details. The Delta pressure should not exceed 345 mbar.

Minimum proof pressure for the TecJet 110 is 2.1 bar gauge.

Minimum burst pressure for the TecJet 110 is 16.0 bar gauge.

Flow Characteristics

Accuracy

The TecJet 110 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 mass flow is within ±20% of the mass flow demand. Throughout the load range, from idle to 100% load, the TecJet 110 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 mass flow and within ±6% of the mass flow demand above 25% of valve maximum rated mass flow.

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 would also significantly affect the accuracy values stated above.

NOTICE

The TecJet 110 will accurately meter fuel to these specifications based on the provided inputs. However, inaccuracies in the user inputs for gas quality and properties can result in different power output to the engine and potentially negatively impact emissions. It is always recommended to have an independent emissions detection and monitoring system to ensure government or regulatory compliance.

Chapter 4.
Valve Sizing

Figures 4-1 through 4-4 show the maximum and minimum amounts of gas that the TecJet 110 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 other TecJet sizes are also shown for comparison purposes.

Comparing the TecJet 110 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 110 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 110.

Comparing the TecJet 110 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 110 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 110.

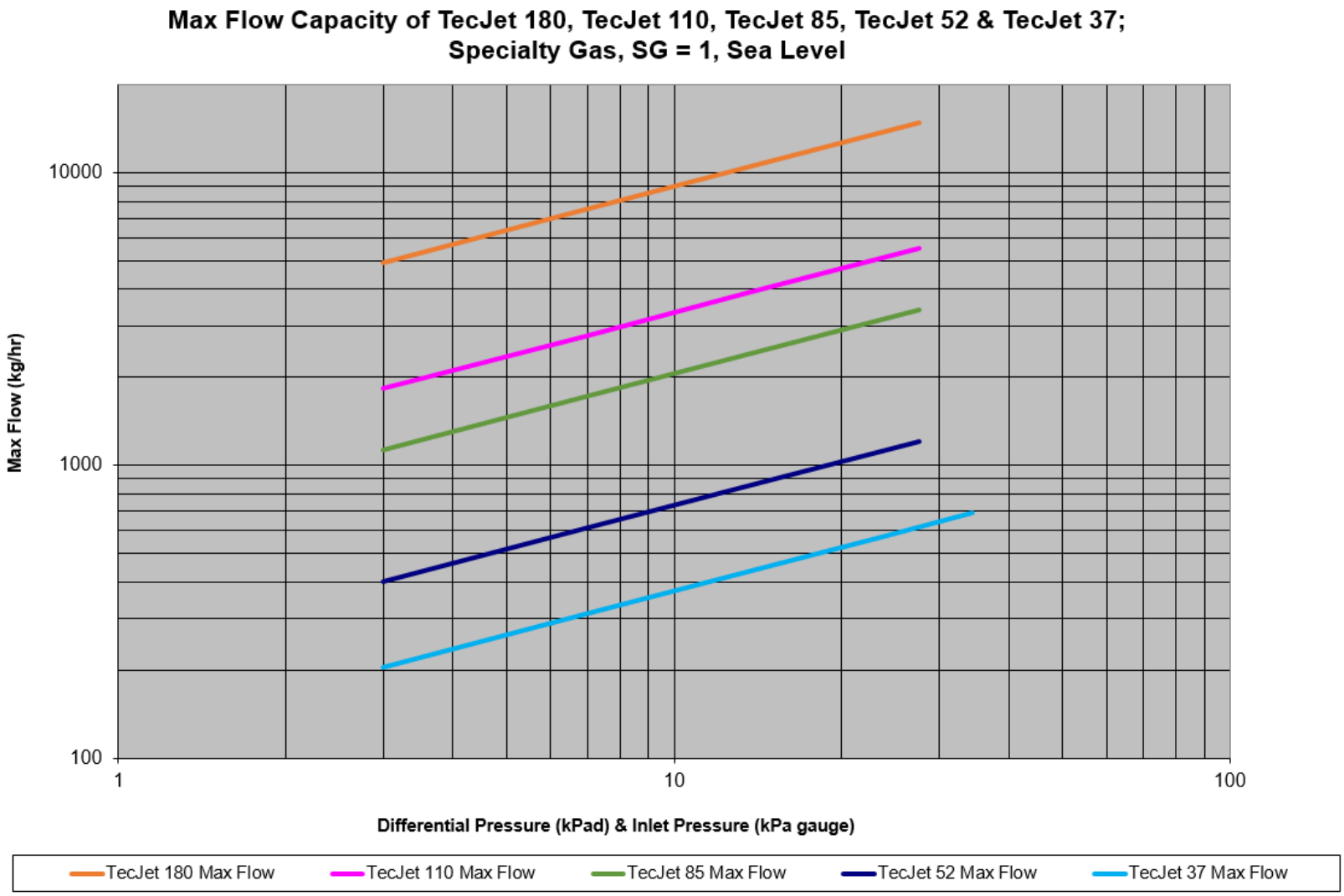


Figure 4-1. Maximum Specialty Gas Flow Capacity of TecJet 180, 110, 85, 52 and 37
(Specialty Gas, SG=1, Sea Level)

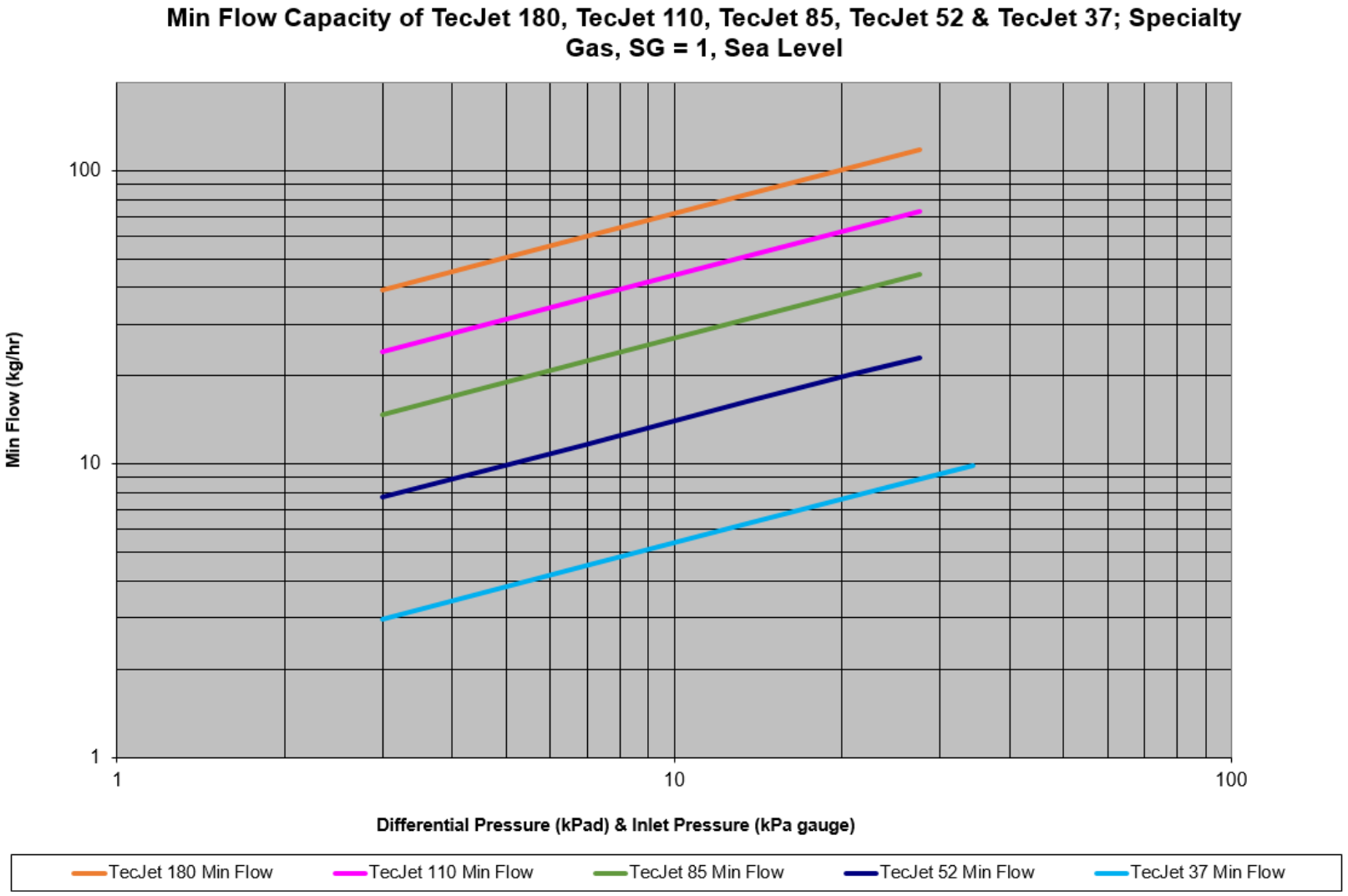


Figure 4-2. Minimum Specialty Gas Flow Capacity of TecJet 180, 110, 85, 52 and 37
(Specialty Gas, SG=1, Sea Level)

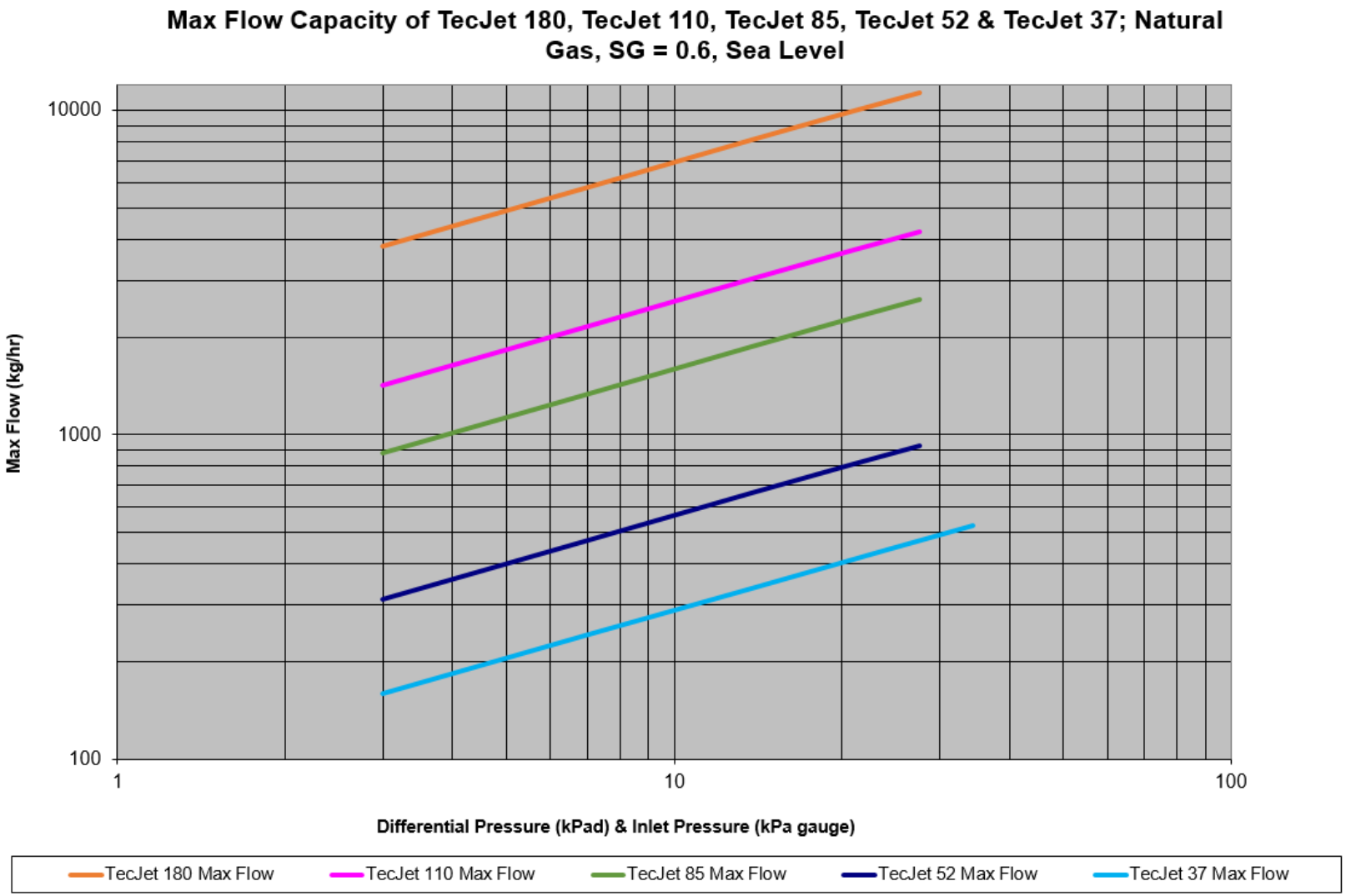


Figure 4-3. Maximum Natural Gas Flow Capacity of TecJet 180, 110, 85, 52 and 37
(Natural Gas, SG=0.6, Sea Level)

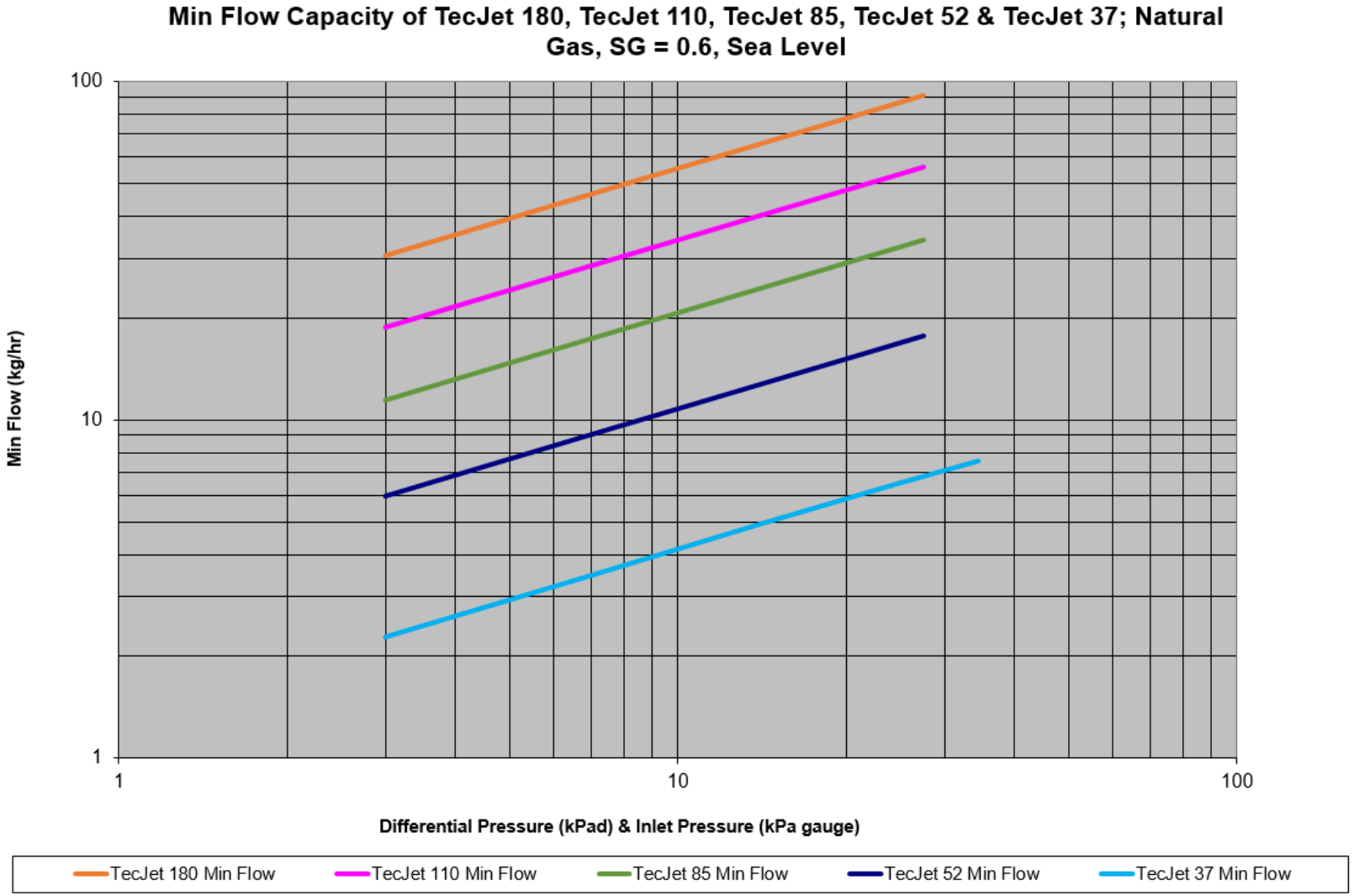


Figure 4-4. Minimum Natural Gas Flow Capacity of TecJet 180, 110, 85, 52 and 37 (Natural Gas, SG=0.6, Sea Level)

Chapter 5.
Service Tool

Overview

The Service Tool software is used to configure, setup, and troubleshoot the TecJet 110 control. This chapter describes the installation and use of the TecJet Service Tool and provides detailed instructions for configuring and setting up the TecJet 110 control for customer-specific applications.

IMPORTANT

Many TecJet 110 units are delivered pre-configured and calibrated with OEM specific settings. These units do not require the use of the Service Tool. However, the Service Tool is a valuable troubleshooting aid.

⚠WARNING

An improperly calibrated control could cause an overspeed or other damage to the engine. To prevent possible serious injury from an over-speeding prime mover, read and follow this entire procedure before starting the engine.

Description

The TecJet Service Tool software resides on a PC (personal computer) and communicates to the TecJet 110 control via RS-232 connection.

A communication harness kit can also be purchased from Woodward (Woodward P/N 1249-1120). See Figure 5-1 for the communication harness connections.

The communication harness kit is a service port adaptor and is not intended to remain in the engine wiring harness during normal operation (only during engine setup). To use this adaptor, a 9-pin straight-through serial cable is needed between the harness transceiver RS-232 port and the PC. This serial cable must include ALL conductors. If it is limited to only pins 2, 3, and 5, it will not function correctly with the adaptor.

Installation

The TecJet Service Tool is available at **www.woodward.com/software**. Select software product "**TecJet Service Tool**". Follow the installation instructions given on that page.

⚠WARNING

An unsafe condition could occur with improper use of these software tools. Only trained personnel should have access to these tools.

System Requirements

The following hardware is required to work with the TecJet 110 control:

- PC-compatible laptop or desktop computer
  - Microsoft Windows XP, 7, or 10
  - 300 MHz Pentium CPU
  - 64 MB of RAM
  - Minimum 800 by 600 pixel screen with 256 colors
- Serial Port
- Serial Extension Cable
- Communication/data link harness.

What to do next

After the software is installed, install the communication harness and connect a straight-through 9-pin serial communications cable between the converter RS-232 port and an unused serial port on your computer. Power must be applied to the TecJet control for the Service Tool to connect.

Run the Service Tool program and, when prompted, select an available com port. This will connect the Service Tool to the TecJet control. Once connected to the control, the Overview screen (Figure 5-2) will open and populate with current values and the status bar will display ‘connected’. The TecJet Demand Source and active Control Status messages are also displayed in an area common to all screens.

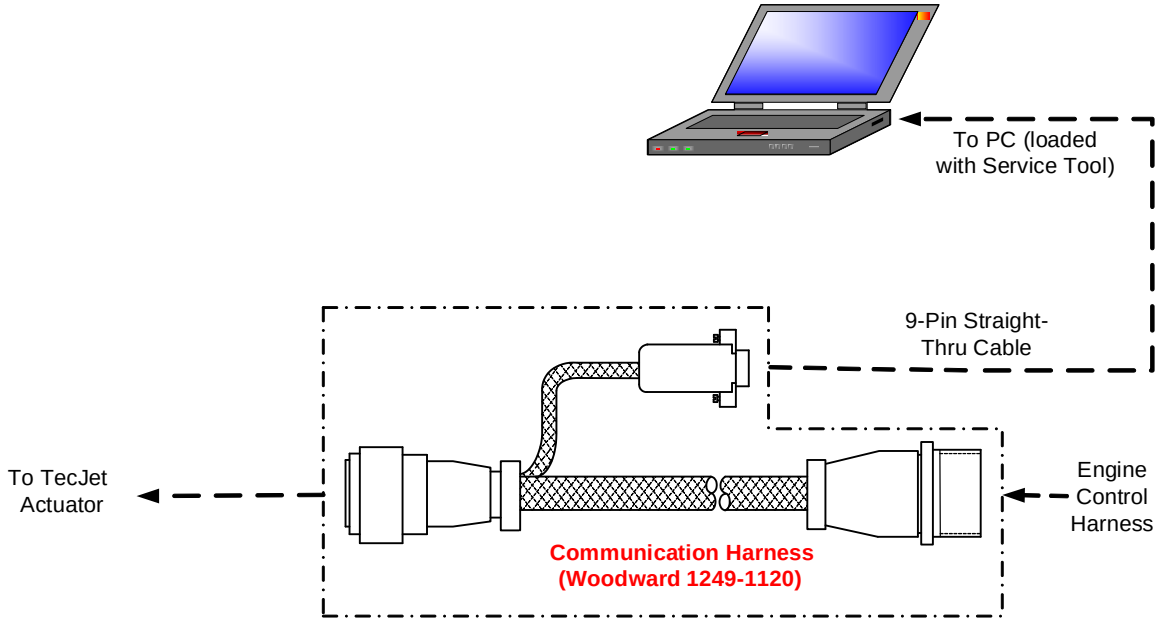


Figure 5-1. Communication- Harness Connections

NOTICE

There is a potential for serial port damage when communicating with the TecJet 110 control. This is caused by a difference in AC voltage between neutral and earth ground. If the PC RS-232 port ground is referenced to AC neutral, and the TecJet 110 control is referenced to battery ground (AC earth ground), a large amount of current can be experienced. To avoid this situation, we strongly recommend placing an isolation transformer between the AC outlet and the PC or run a laptop with the AC power disconnected.

Service Tool Help

Online Service Tool help is available and included with the installation of the Service Tool product. Help can be accessed from the Service Tool ‘Help’ menu located on the main screen

Service Tool Security

There are no password security levels provided by the TecJet Service Tool.

Troubleshooting the Driver

The Service Tool has six (6) screens for troubleshooting driver parameters:

- Overview (Figure 5-2)
- Troubleshooting (Figure 5-3)
- Warnings (Figure 5-4)
- Errors (Figure 5-5)
- Configuration (Figure 5-6)
- Identification (Figure 5-7)

Screen Navigation

Service Tool screens can be selected for viewing by clicking the various tabs provided on the main and edit configuration screens.

Overview Screen

The Overview screen is the default screen that opens when connecting the TecJet Service Tool to the TecJet control. The Overview screen displays TecJet flow parameters and the valve position. The status bar, common to all screens, displays the communication, warning and error status. The triangular warning symbol turns yellow with a warning is active. The round error symbol turns red with an error is active.

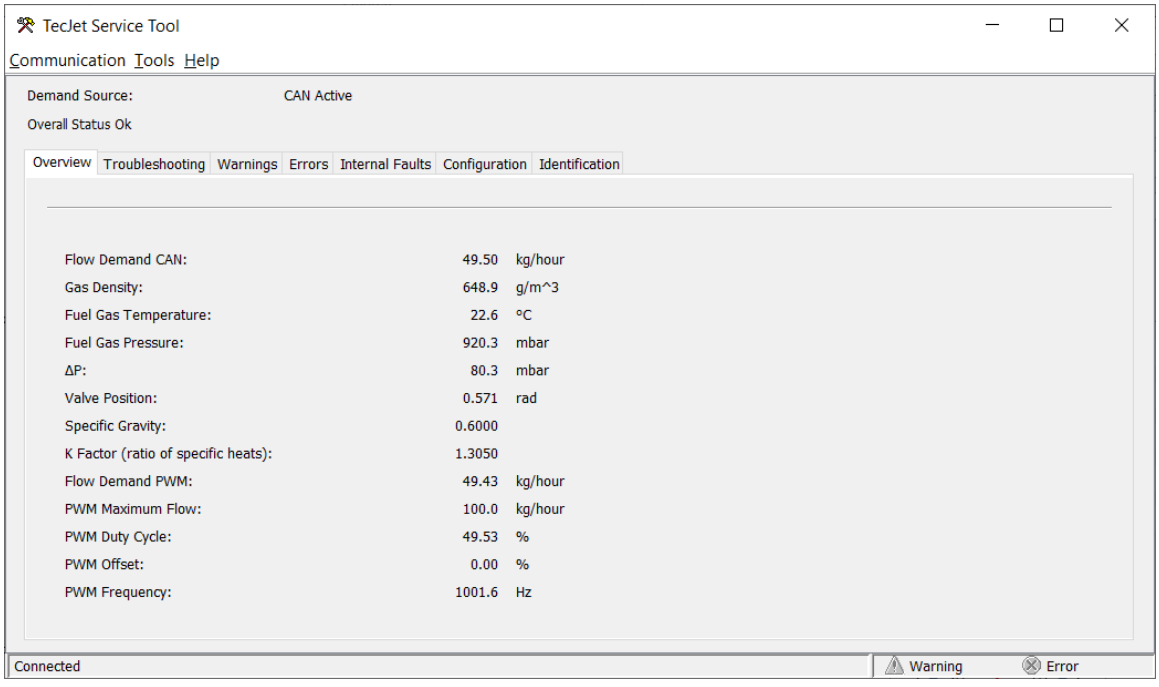


Figure 5-2. Overview Screen

Flow Demand CAN or PWM
Displayed value of the flow demand input, in kilograms/hour.

Gas Density
Displayed value of the gas density, in grams/cubic meter, at FGT and FGP.

Fuel Gas Temperature (FGT)
Displayed value of the inlet fuel gas temperature, in degrees Celsius.

Fuel Gas Pressure (FGP)
Displayed value of the inlet fuel gas pressure, in millibar absolute.

ΔP
Displayed value of the valve differential pressure, in millibar differential.

Valve Position
Displayed value of the valve position, in radians.

Specific Gravity
Displayed value of the programmed gas specific gravity, unitless.

K Factor
Displayed value of the programmed gas K factor (ratio of specific heats), unitless.

PWM Max Flow
Displayed value of the programmed PWM Max Flow, in kilograms/hour.

PWM Duty Cycle
Displayed value of the PWM input duty cycle, in %.

PWM Offset
Displayed value of the programmed PWM offset, in %.

PWM Frequency (PWM Demand Source Configuration Only)
Displayed value of the PWM input frequency, in hertz.

Troubleshooting Screen

Select the Troubleshooting tab to view general TecJet control parameters. This screen dynamically populates based on the TecJet configuration. If a function is not programmed, then it will not appear.

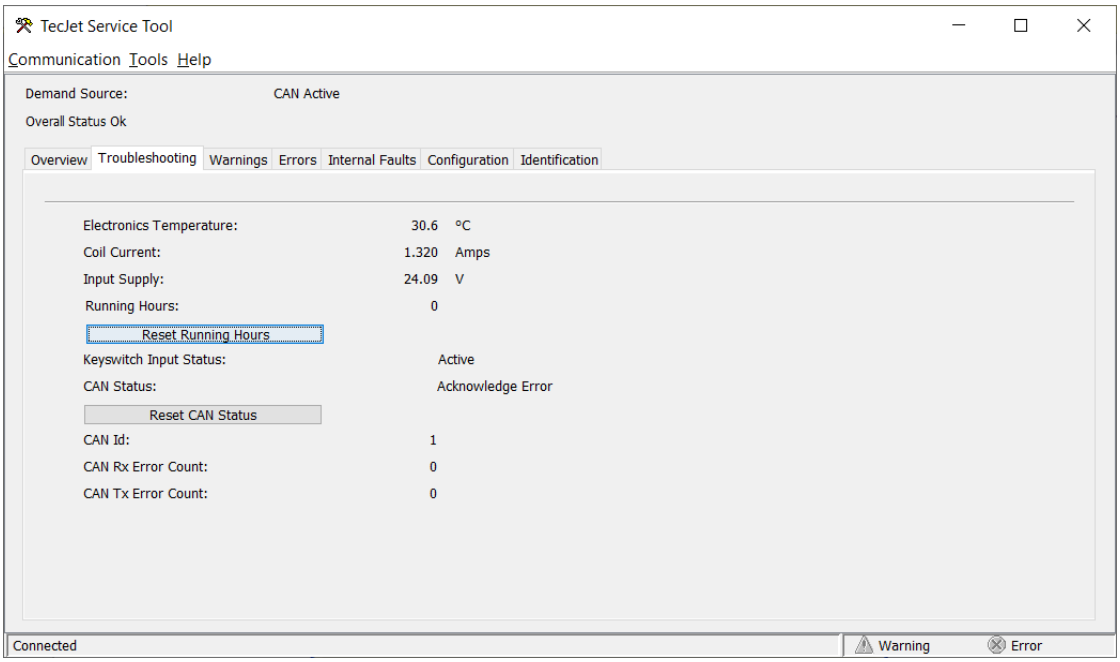


Figure 5-3. Troubleshooting Screen

Electronics Temperature
Displayed value of the electronics temperature sensor, in degrees Celsius.

Coil Current
Displayed value of the estimated actuator coil current, in amperes.

Input Supply
Displayed value of the input power, in volts.

Running Hours
Displayed value of the running hours.

Reset Running Hours
To reset the running hours to zero, click the ‘Reset Running Hours’ button.

Keyswitch Input Status
Displayed status of the keyswitch input. Value is active or inactive.

CAN Status
Displayed value of the CAN status (e.g., error passive, stuff error, etc.)

Reset CAN Status
To clear the displayed CAN status, click the ‘Reset CAN Status’ button.

CAN Id
Displayed value of the CAN identification number. Value is 1, 2, 3 or 4.

CAN Rx Error Count
Displayed value of the CAN receive error counter.

CAN Tx Error Count
Displayed value of the CAN transmit error counter.

Warnings Screen

WARNING **It is recommended that all faults be used and configured as shutdowns to ensure maximum fault protection.**

Select the Warnings tab to view TecJet active or previously active warning conditions. Warnings indicate a problem has occurred that needs attention, but the valve attempts continued operation. This screen dynamically populates based on the TecJet configuration. If a function is not programmed, then it will not appear. A Reset Warnings button is provided to clear inactive warnings.

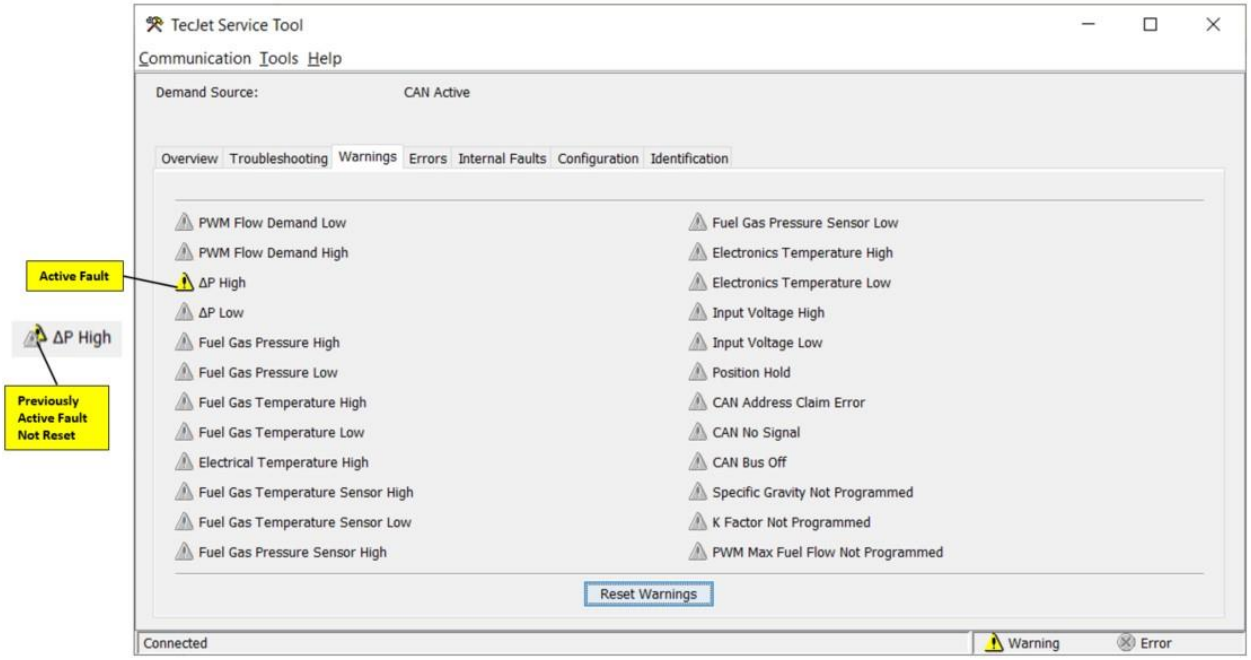


Figure 5-4. Warnings Screen

IMPORTANT **Refer to Troubleshooting, Chapter 6, for a description of each displayed Warning plus possible causes and remedial actions.**

Errors Screen

Select the Errors tab to view active TecJet error conditions. Errors indicate a serious problem has occurred and the valve is not able to operate. This screen dynamically populates based on the TecJet configuration. If a function is not programmed, then it will not appear. A Reset Logged Faults button is provided to clear inactive faults. Active faults can only be cleared with a power cycle.

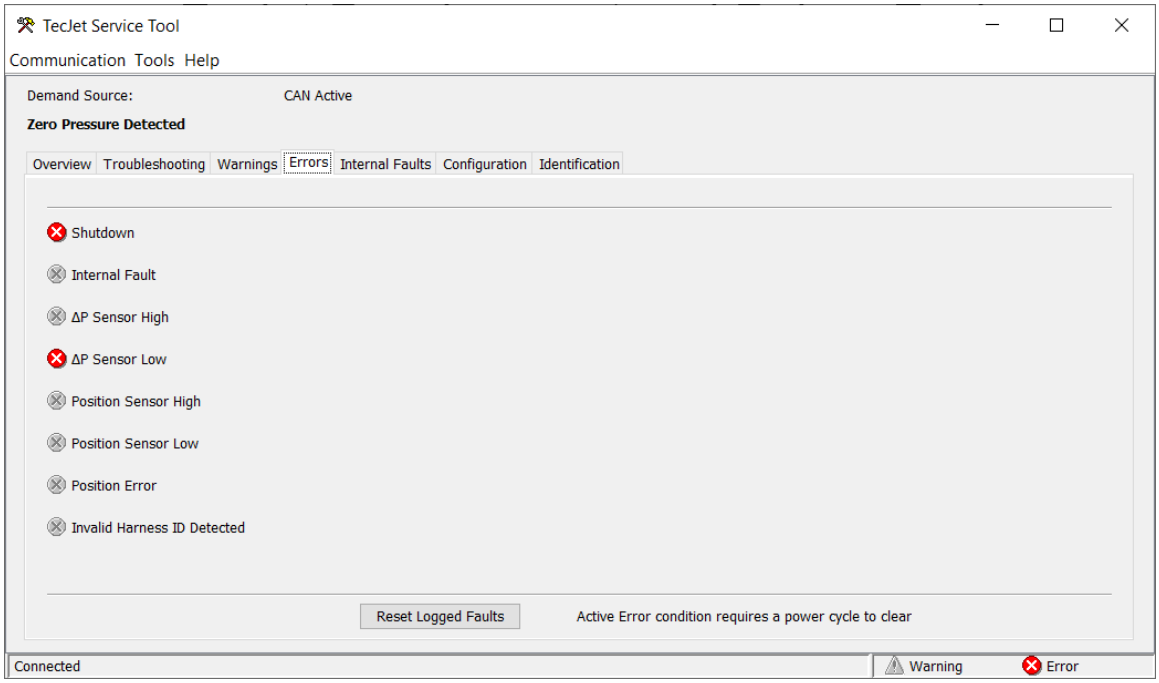


Figure 5-5a. Errors Screen before Power Cycle

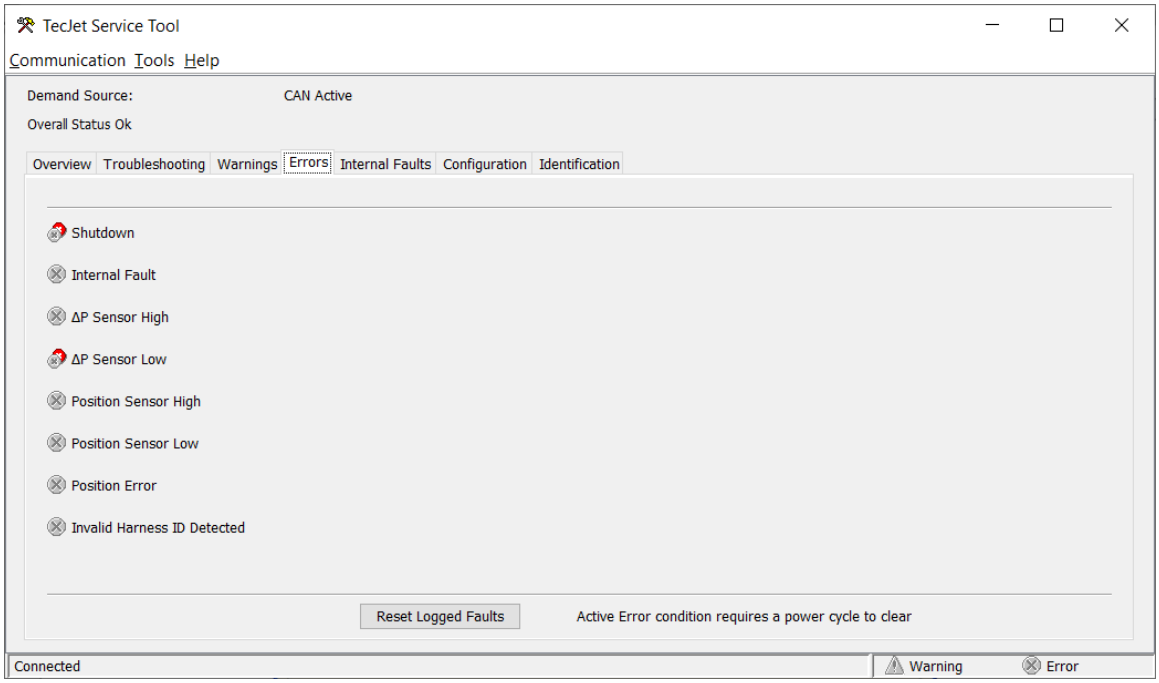


Figure 5-5b. Errors Screen after Power Cycle

Shutdown
Indicates the valve is closed or attempting to close due to a detected error.

Internal Fault
Indicates an internal fault has occurred that prevents normal operation of the valve.

ΔP Sensor High
Indicates the Delta Pressure value has exceeded the delta pressure sensor's electrical high limit threshold.

ΔP Sensor Low
Indicates the Delta Pressure value has exceeded the delta pressure sensor's electrical low limit threshold.

Position Sensor High
Indicates that the Valve Position value has exceeded the position sensor's electrical high limit threshold.

Position Sensor Low
Indicates that the Valve Position value has exceeded the position sensor's electrical low limit threshold.

Position Error
Indicates the position feedback is not following the position demand. Position Error detection logic is designed to account for normal actuator response times to prevent unwarranted position error indications during transient conditions.

Invalid Harness ID
Indicates the control does not have a valid Harness ID.

IMPORTANT **Following a detected error, the TecJet valve will not attempt to operate again until power to the valve is cycled. If an error persists, the valve must be replaced.**

Configuration Screen

Select the Configuration tab to view the TecJet configuration. This screen dynamically populates based on the existing TecJet configuration. If a function is not programmed, then it will not appear. The configuration settings are grouped into 4 or 5 sub-screens. Select a sub-tab to view the configuration settings for that group.

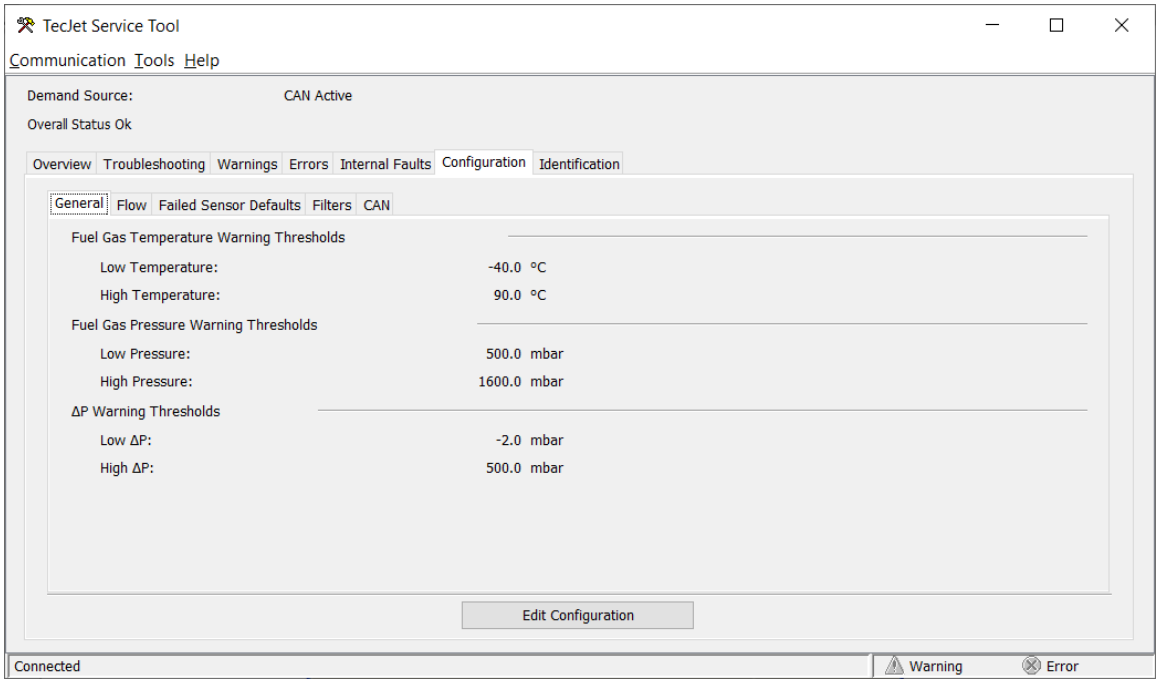


Figure 5-6. Configuration Screen

Identification Screen

Select the Identification tab to view TecJet identification information.

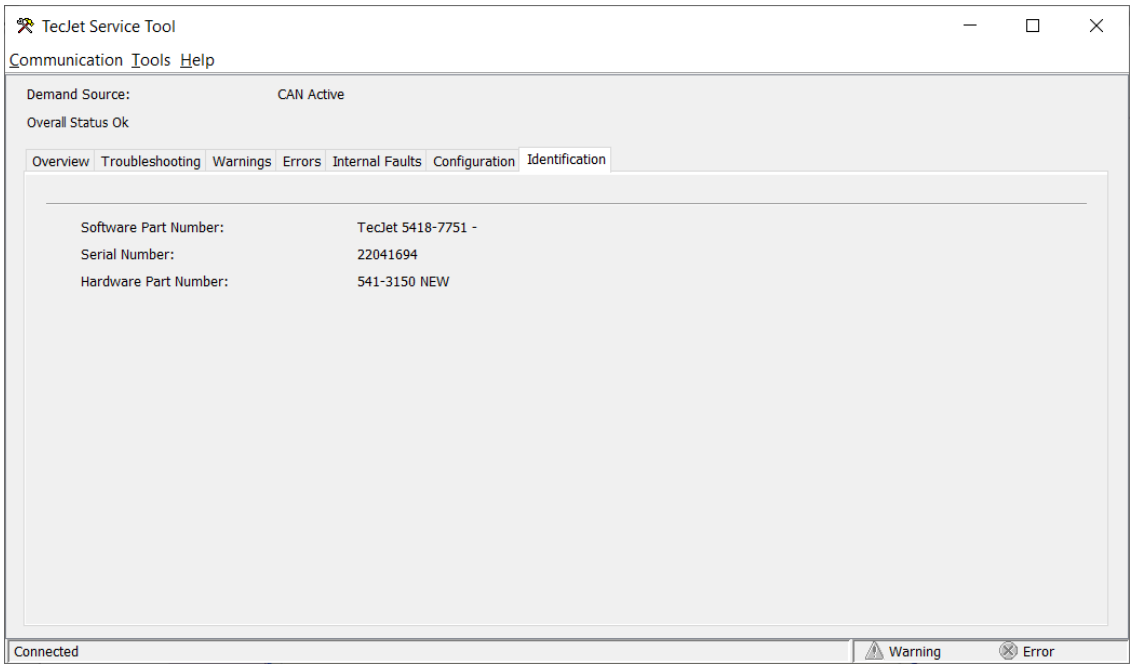


Figure 5-7. Identification Screen

Software Part Number
Displayed software part number and revision letter.

Serial Number
Displayed TecJet valve serial number.

Hardware Part Number
Displayed TecJet valve part number and revision letter.

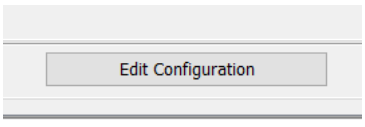
Configuring the Driver

The Service Tool has six (6) screens for editing the driver configuration:

- Edit TecJet Configuration, General (Figure 5-8)
- Edit TecJet Configuration, Flow (Figure 5-9)
- Edit TecJet Configuration, Failed Sensor Defaults (Figure 5-10)
- Edit TecJet Configuration, Filters (Figure 5-11)
- Edit TecJet Configuration, CAN (Figure 5-12a, 12b)

Edit Configuration

To change the TecJet configuration, click the Edit Configuration button on the Configuration screen (see Figure 5-6).



This opens an Edit TecJet Configuration screen, (e.g., Figure 5-8), to permit driver configuration setting changes. The configuration settings are provided in a common area of the Edit TecJet Configuration screen and on several tabbed screens.

WARNING

Configuration changes will not take effect until they are loaded to the control. Review ALL settings shown on ALL tabbed Edit TecJet Configuration screens to verify all configuration settings are correct before loading the settings to the control.

An improperly calibrated control could cause an overspeed or other damage to the engine.

Edit TecJet Configuration - General

This is an edit screen for general control configuration settings. To change a value, highlight the value and type the desired value. The status bar displays the valid adjustable range for the highlighted value.

Note, Demand Source options may change depending on firmware loaded.

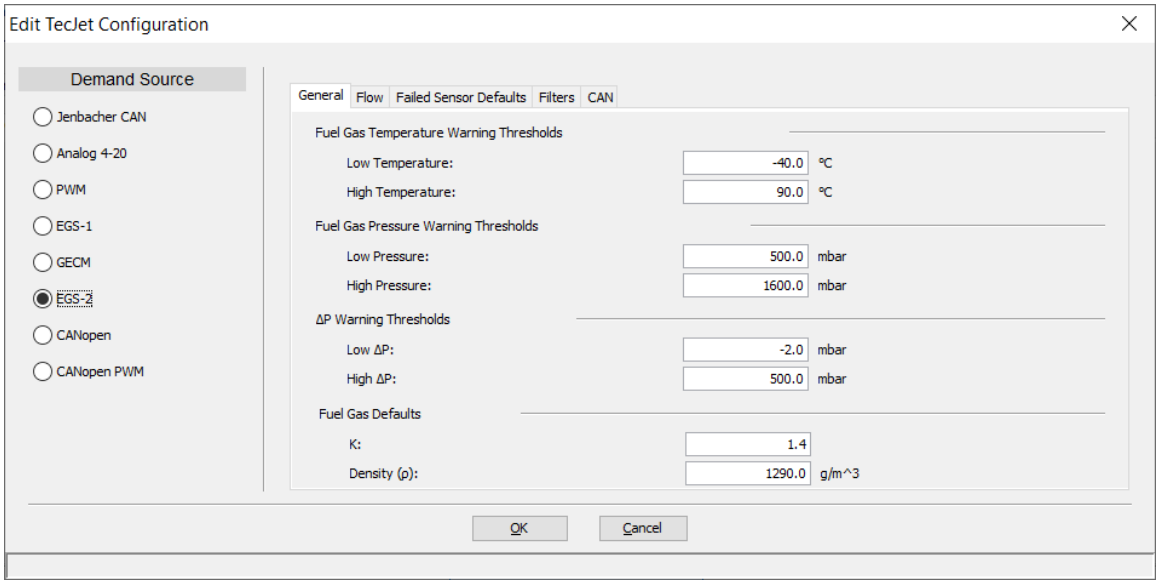


Figure 5-8. Edit TecJet Configuration - General

Fuel Gas Temperature Warning Thresholds - Low Temperature
Sets the temperature, in ºC, which triggers a Fuel Gas Temperature Low warning indication.
Adjustable range: -40 to 25º C

Fuel Gas Temperature Warning Thresholds - High Temperature
Sets the temperature, in ºC, which triggers a Fuel Gas Temperature High warning indication.
Adjustable range: 25 to 90º C

Fuel Gas Pressure Warning Thresholds - Low Pressure
Sets the pressure, in millibar, which triggers a Fuel Gas Pressure Low warning indication.
Adjustable range: 0 to 1600 mbar

Fuel Gas Pressure Warning Thresholds - High Pressure
Sets the pressure, in millibar, which triggers a Fuel Gas Pressure High warning indication.
Adjustable range: 0 to 1600 mbar

ΔP Warning Thresholds - Low ΔP
Sets the differential pressure, in millibar, which triggers a ΔP Low warning indication.
Adjustable range: 0 to 1600 mbar

ΔP Warning Thresholds - High ΔP
Sets the pressure, in millibar, which triggers a ΔP High warning indication.
Adjustable range: 0 to 1600 mbar

Fuel Gas Defaults - K
Sets the fuel gas ratio of specific heats used by the flow algorithm when values are not received on the CAN bus or when CAN is not configured.
Adjustable Range: 1.0 to 2.0

Fuel Gas Defaults - Density (ρ)
Sets the fuel gas normal density, in grams/cubic meter at flowing temperature (FGT) and pressure (FGP), used by the flow algorithm when values are not received on the CAN bus or when CAN is not configured.
Adjustable Range: 400.0 to 2600.0 g/m³

Edit TecJet Configuration - Flow

This screen provides for editing the Flow configuration settings used by the control. This screen dynamically populates based on the Demand Source configuration. If a parameter is not applicable for the configured demand source, then it will not appear. To change a value, highlight the value and type the desired value. The status bar displays the valid adjustable range for the highlighted value.

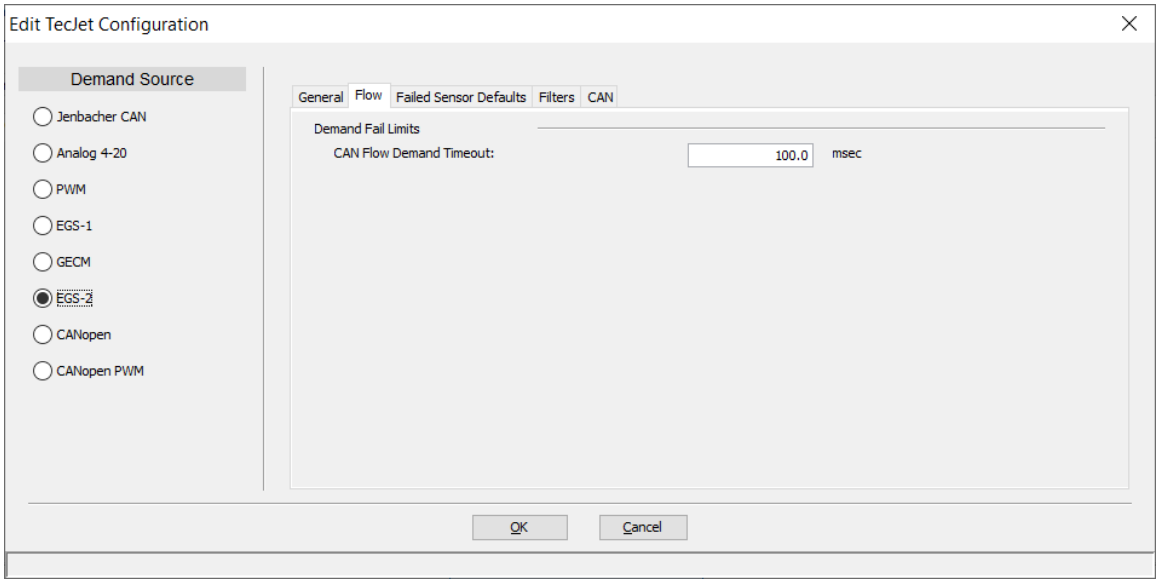


Figure 5-9a. Edit TecJet Configuration - Flow (CAN Demand)

CAN Flow Demand Timeout
Sets the timeout period, in milliseconds, which triggers a CAN Flow Demand Failed warning.
Adjustable range: 10.0 to 10000.0 ms

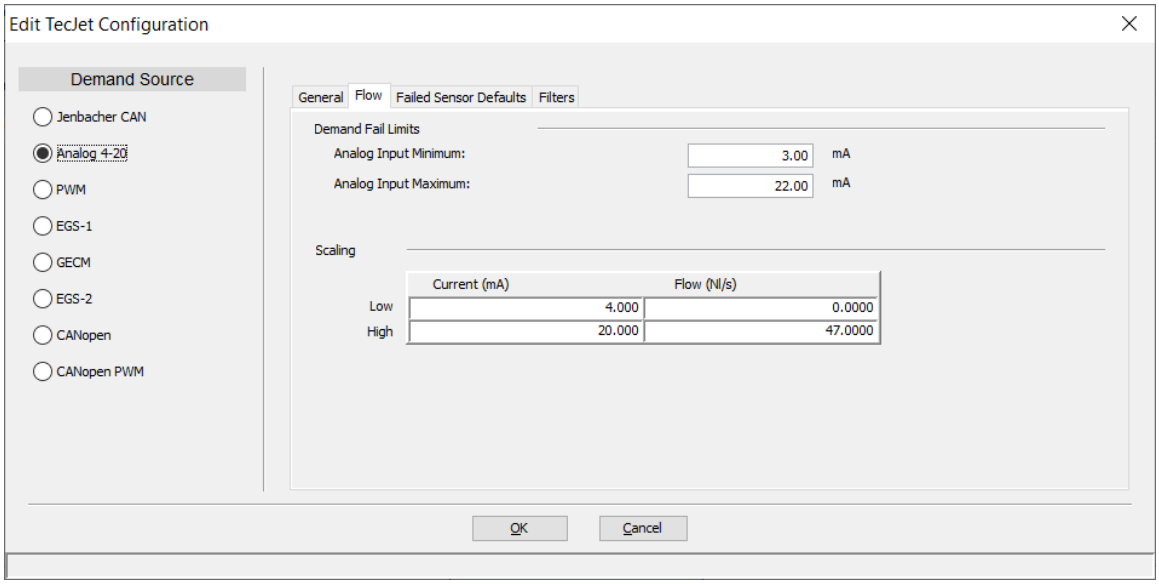


Figure 5-9b. Edit TecJet Configuration - Flow (Analog Demand)

Analog Input Minimum
Sets the current, in milliamps, which triggers an Analog Flow Demand Low warning.
Adjustable range: 0–22 mA

Analog Input Maximum
Sets the current, in milliamps, which triggers an Analog Flow Demand High warning.
Adjustable range: 0–22 mA

Scaling
Sets the low and high values for scaling the analog demand source versus fuel flow. The current range set by the scaling/low/current and scaling/high/current settings will cause the TecJet valve to deliver the corresponding fuel flow set by the scaling/low/flow and scaling/high/flow settings. Intermediate values are linear with between these low and high settings.

- **Scaling, Current, Low**
  Sets the current, in milliamps, which corresponds to the Low Flow setting.
  Adjustable range: 3-22 mA
- **Scaling, Current, High**
  Sets the current, in milliamps, which corresponds to the High Flow setting.
  Adjustable range: 3-22 mA
- **Scaling, Flow, Low**
  Sets the flow, in normal liters/second, for the corresponding Low Current setting.
  Adjustable range: 0–2000 Nl/s
- **Scaling, Flow, High**
  Sets the flow, in normal liters/second, for the corresponding High Current setting.
  Adjustable range: 0–2000 Nl/s

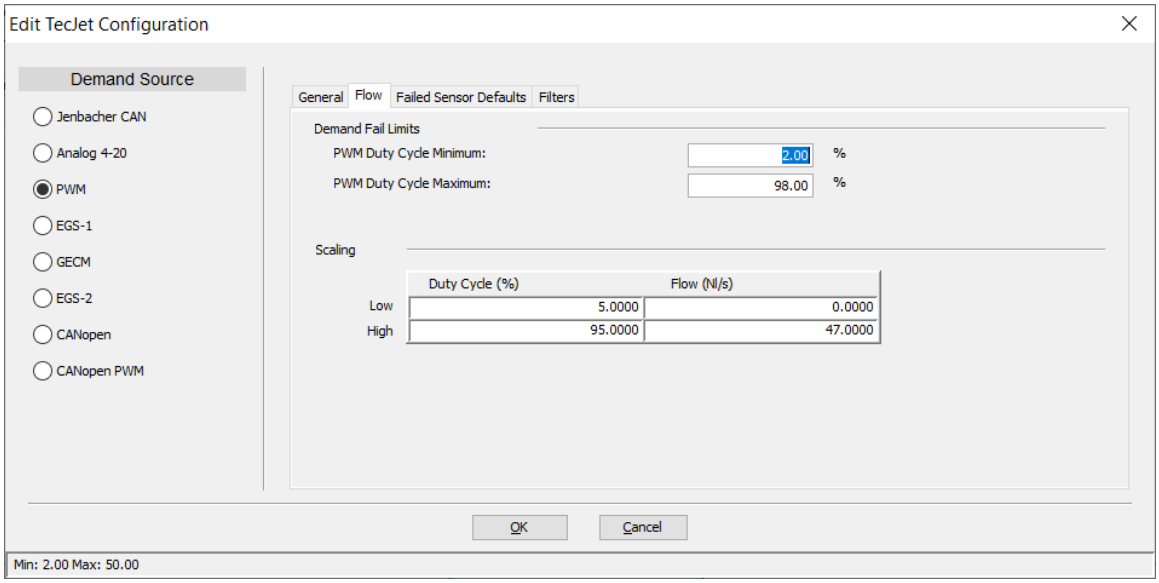


Figure 5-9c. Edit TecJet Configuration - Flow (PWM Demand)

PWM Duty Cycle Minimum
Sets the PWM duty cycle, in percent, which triggers a PWM Flow Demand Low warning.
Adjustable range: 2 to 50 %

PWM Duty Cycle Maximum
Sets the PWM duty cycle, in percent, which triggers a PWM Flow Demand High warning.
Adjustable range: 50 to 98%

PWM Offset
Sets the PWM Offset, in percent.
Adjustable range: -15 to 15%

Scaling
Sets the low and high values for scaling the PWM demand source versus fuel flow. The duty cycle range set by the scaling/low/duty cycle and scaling/high/duty cycle settings will cause the TecJet valve to deliver the corresponding fuel flow set by the scaling/low/flow and scaling/high/flow settings. Intermediate values are linear with between these low and high settings.

- **Scaling, Duty Cycle, Low**
  Sets the PWM duty cycle, which corresponds to the Low Flow setting.
  Adjustable range: 5-95 %
- **Scaling, Duty Cycle, High**
  Sets the PWM duty cycle, which corresponds to the High Flow setting.
  Adjustable range: 5-95 %
- **Scaling, Flow, Low**
  Sets the flow, in normal liters/second, for the corresponding Low Duty Cycle setting.
  Adjustable range: 0–2000 Nl/s
- **Scaling, Flow, High**
  Sets the flow, in normal liters/second, for the corresponding High Duty Cycle setting.
  Adjustable range: 0–2000 Nl/s
  Set by the CAN Bus

Edit TecJet Configuration - Failed Sensor Defaults

This screen provides for editing the Failed Sensor Default configuration settings used by the control in the event a sensor input fails. To change a value, highlight the value and type the desired value. The status bar displays the valid adjustable range for the highlighted value.

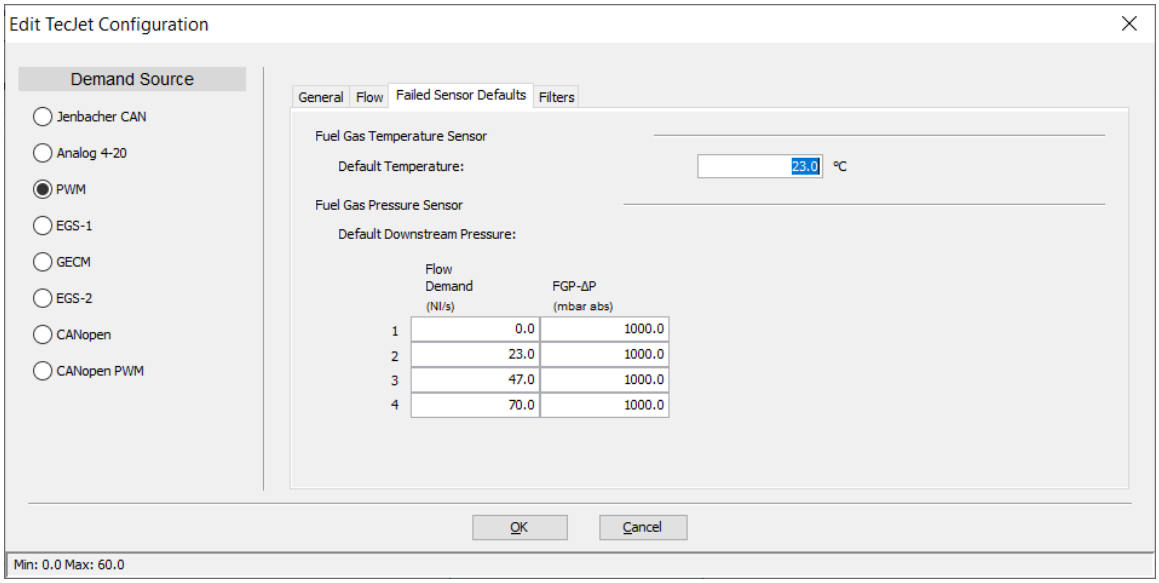


Figure 5-10. Edit TecJet Configuration - Failed Sensor Defaults

Default Temperature
Sets the temperature, in °C, the control will use to continue operation upon failure of the fuel gas temperature sensor.
Adjustable range: 0 to 60 °C

Default Downstream Pressure
This sets an estimated pressure, in millibar absolute that the control will use to continue operation upon failure of the fuel gas pressure sensor.

Estimate is based on a 4-point curve of the flow demand, in normal liters/second, versus default downstream pressure, in millibar absolute.
(Estimated FGP = Default Downstream Pressure + ΔP).

- **Flow Demand [1-4]**
  Sets the flow demand [1-4], in normal liters/second, which corresponds to the default downstream pressure setting.
  Adjustable range: 0–2000 Nl/s
- **FGP- ΔP [1-4]**
  Sets the default downstream pressure [1-4], in mbar abs, for the corresponding flow demand [1-4] settings.
  Adjustable range: 0–2000 mbar abs

Edit TecJet Configuration - Filters

This screen provides for editing various input signal filter configuration settings. To change a value, highlight the value and type the desired value. The status bar displays the valid adjustable range for the highlighted value. The filters are provided for system troubleshooting purposes, and should be set to 0 in normal applications.

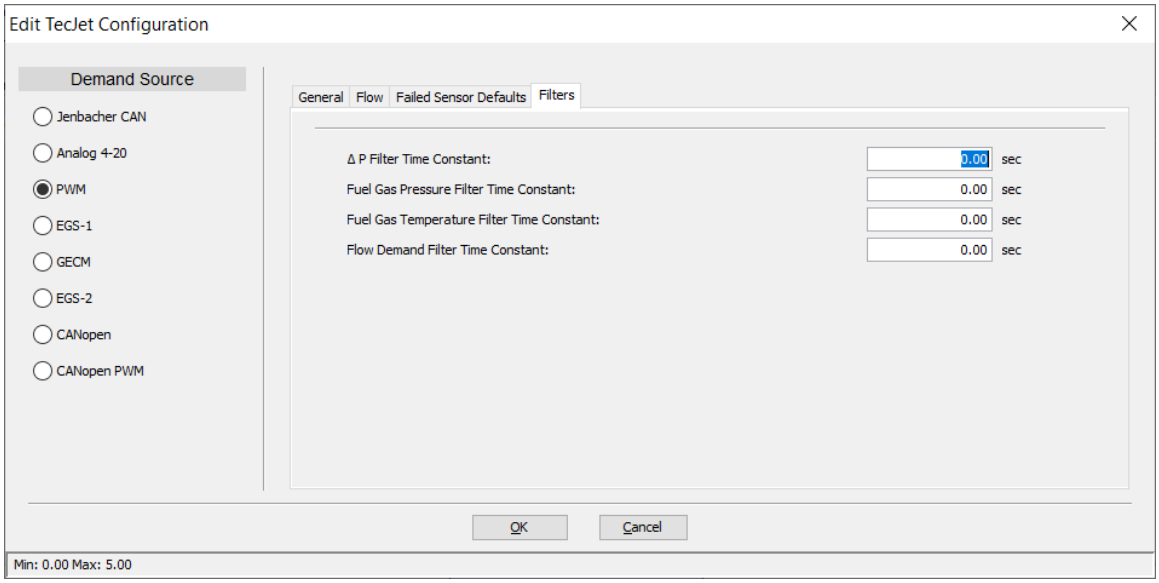


Figure 5-11. Edit TecJet Configuration - Filters

ΔP Filter Time Constant
Sets the Delta P sensor time constant. There is a single-pole lag between the delta P sensor and the flow algorithm.
Adjustable range: 0 to 5 sec

Fuel Gas Pressure Filter Time Constant
Sets the Fuel Gas Pressure sensor time constant. There is a single-pole lag between the fuel gas pressure sensor and the flow algorithm.
Adjustable range: 0 to 5 sec

Fuel Gas Temperature Filter Time Constant
Sets the Fuel Gas Temperature sensor time constant. There is a single-pole lag between the fuel gas temperature sensor and the flow algorithm.
Adjustable range: 0 to 5 sec

Flow Demand Filter Time Constant
Sets the Flow Demand time constant. There is a single-pole lag between the flow demand value and the flow algorithm.
Adjustable range: 0 to 5 sec

Edit TecJet Configuration - CAN

This screen provides for editing CAN communication configuration settings. To select a ‘Default’ or ‘User Configured’ baud rate, click the radio button adjacent to the choice.

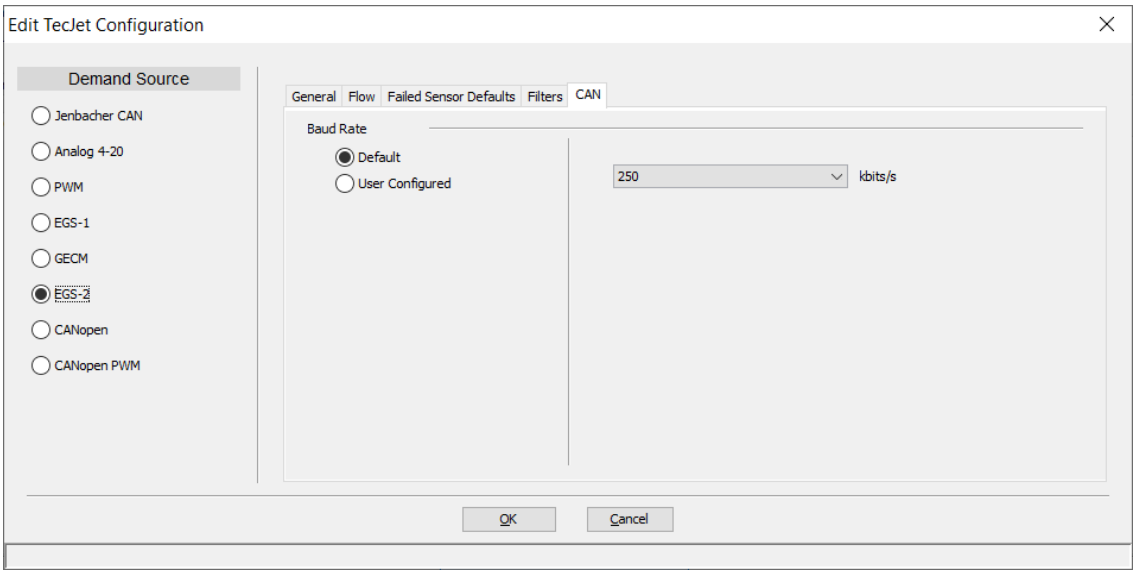


Figure 5-12a. Edit TecJet Configuration - CAN (Default)

Baud Rate, Default

Sets the default baud rate of the CAN communication in kbps.
Adjustable range: 10, 50, 100, 125, 250, 500, or 1000 kbps.

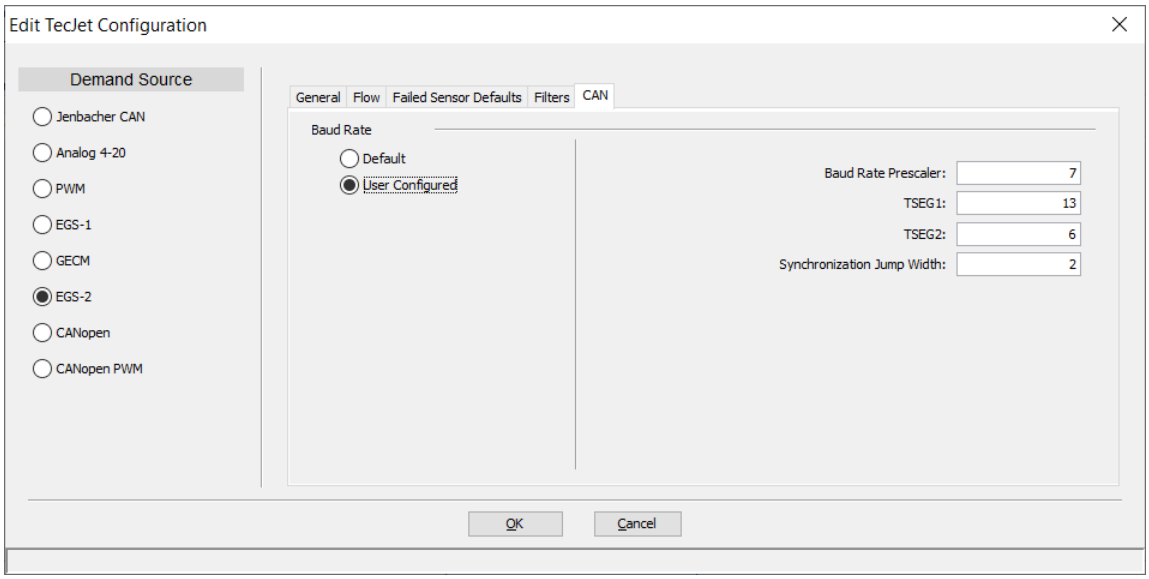


Figure 5-12b. Edit TecJet Configuration - CAN (User Configured)

Baud Rate, User Configured

Provides user settings for more flexible control of the CAN parameters. This option should be used by advanced users only. The baud rate of the CAN communication is calculated from these settings as follows:

Baud Rate = 40E6 / [(BRP + 1) x (TSEG1 + TSEG2 + 1)]

- **Baud Rate Prescaler (BRP)**
  Sets the baud rate prescaler in the CAN controller.
  Adjustable range: 0 to 255

- **TSEG01**
  Sets the Tseg1 value in the CAN controller. Tseg1 combines the PROP_SEG and PHASE_SEG1 segments of the CAN protocol.
  Adjustable range: 3 to 16
- **TSEG02**
  Sets the Tseg2 value in the CAN controller. Tseg2 defines the PHASE_SEG2 segment of the CAN protocol.
  Adjustable range: 2 to 8
- **Synchronization Jump Width**
  Determines the synchronization jump width in the CAN controller.
  Adjustable range: 1 to 4

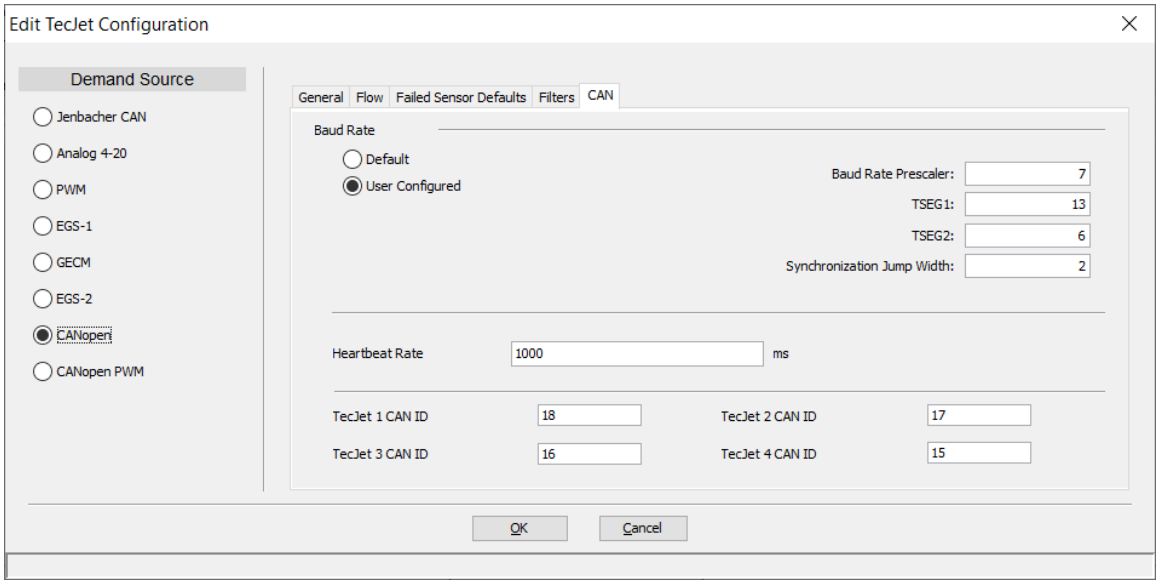


Figure 5-12c. Edit TecJet Configuration- CAN (User Configured)

Heartbeat Rate

- Sets the heartbeat producer time, in milliseconds, when CANopen is used.
  Adjustable range: 0–65535 ms

TecJet CAN ID

Provides device identifiers for TecJet 1-4, which is selected on power up based on the CAN ID HIGH and LOW inputs.

- **TecJet 1 CAN ID**
  Sets the device identifier used when device 1 is selected.
  Adjustable range: 1–31
- **TecJet 2 CAN ID**
  Sets the device identifier used when device 2 is selected.
  Adjustable range: 1–31
- **TecJet 3 CAN ID**
  Sets the device identifier used when device 3 is selected.
  Adjustable range: 1–31
- **TecJet 4 CAN ID**
  Sets the device identifier used when device 4 is selected.
  Adjustable range: 1–31

Load Configuration Settings

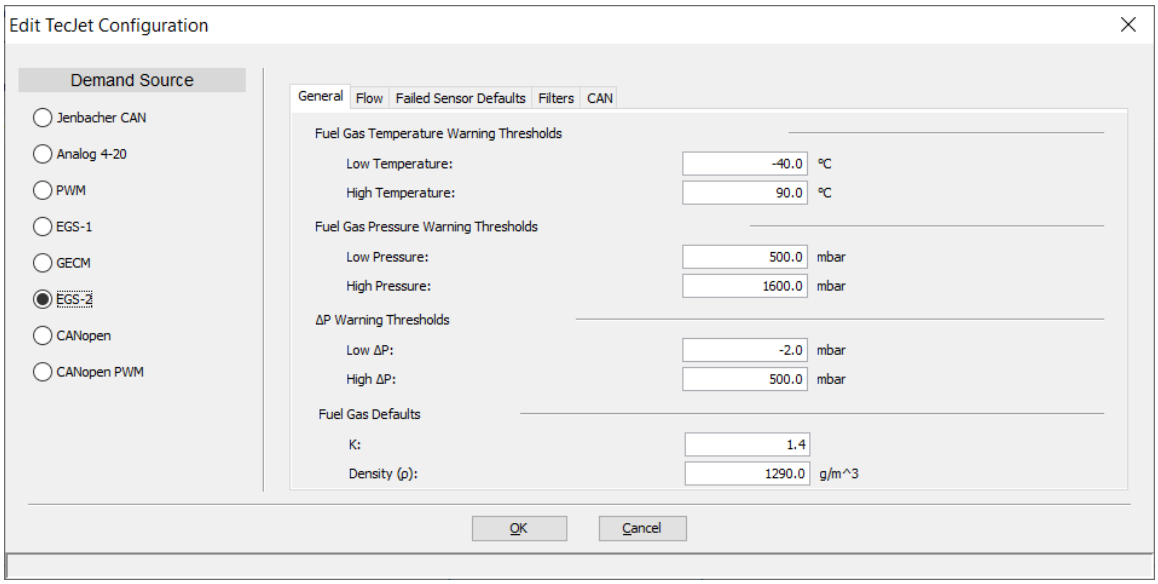


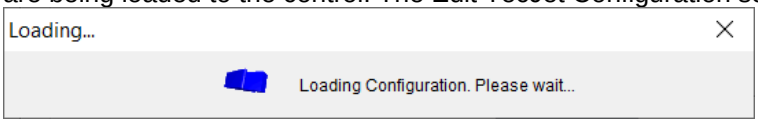
Figure 5-13. Load Configuration Settings

WARNING

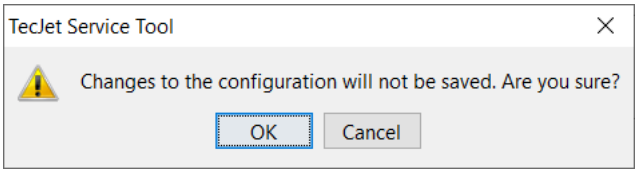
Review ALL settings shown on ALL tabbed Edit TecJet Configuration screens to verify that all configuration settings are correct before loading settings to the control. Configuration changes do not take effect until they are loaded to the control.

An improperly calibrated control could cause an overspeed or other damage to the engine.

To load the configuration changes to the TecJet control, click the ‘OK’ button on the Edit TecJet Configuration screen. A Loading Configuration message will appear to verify the configuration settings are being loaded to the control. The Edit TecJet Configuration screen closes after the settings are loaded.



Click the ‘Cancel’ button to exit the Edit TecJet Configuration screen without saving the configuration changes to the control. A message will appear asking for verification that the configuration changes are not to be saved to the control.



Chapter 6. Troubleshooting

The tables in this chapter refer to status indications, warnings, and errors that can be viewed on the Service Tool. See Chapter 5 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

Table 6-1. Status Indications Troubleshooting

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 110 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 110 valve are clean and operating correctly.
		Pressure regulator problem.	Adjust the inlet gas pressure to the correct value.

Table 6-1. Status Indications Troubleshooting (cont'd.)

Status	Description	Possible Cause	Possible Actions
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.
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.

Warnings

Table 6-2. Warnings Troubleshooting

⚠WARNING

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.
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 110 flow demand message.

Table 6-2. Warnings Troubleshooting (cont'd.)

Warning	Description	Possible Cause	Possible Actions
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.
Delta P Low	The Delta Pressure value is below the delta pressure low warning threshold.	Warning threshold improperly configured.	Configure warning threshold for value appropriate to the application.
		Valve is installed backwards.	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.	Reduce ambient temperature.
		Internal fault.	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.

Table 6-2. Warnings Troubleshooting (cont'd.)

Warning	Description	Possible Cause	Possible Actions
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.	Configure warning threshold for value appropriate to the application.
		Pressure regulator adjusted too high.	Adjust pressure regulator.
		Faulty or slow 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.	Configure warning threshold for value appropriate to the application and the elevation of the site.
		Improper engine shutdown sequence.	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.	Configure warning threshold for value appropriate to the application.
		Fuel temperature is above warning threshold.	Correct fuel temperature problem.
Fuel Gas Temperature Low	The Fuel Gas Temperature value is below the fuel gas temperature low warning threshold.	Warning threshold improperly configured.	Configure warning threshold for value appropriate to the application.
		Fuel temperature is below warning threshold.	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.

Table 6-2. Warnings Troubleshooting (cont'd.)

Warning	Description	Possible Cause	Possible Actions
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.	Check battery or supply for correct operation.
		Faulty or no battery charger.	Check battery charger for correct operation.
		Improper wiring.	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.	Check battery or supply for correct operation.
		Faulty or no battery charger.	Check battery charger for correct operation.
		Improper wiring.	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.	Check the PWM input wiring for shorts, open connections and intermitted contacts.
		PWM frequency is out of range.	Verify that the PWM frequency from the ECM is within specified limits.
		PWM duty cycle is out of range.	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.	Check the PWM input wiring for shorts, open connections and intermitted contacts.
		PWM frequency is out of range.	Verify that the PWM frequency from the ECM is within specified limits.
		PWM duty cycle is out of range.	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.

Table 6-3. Errors Troubleshooting

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 7. Maintenance

General

Build-up of deposits near the metering area of the TecJet 110 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.

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 110 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.
Product Support and Service Options

Product Support Options

If you are experiencing problems with the installation, or unsatisfactory performance of a Woodward product, the following options are available:

1. Consult the troubleshooting guide in the manual.
2. Contact the **OE Manufacturer or Packager** of your system.
3. Contact the **Woodward Business Partner** serving your area.
4. Contact Woodward technical assistance via email (**EngineHelpDesk@Woodward.com**) with detailed information on the product, application, and symptoms. Your email will be forwarded to an appropriate expert on the product and application to respond by telephone or return email.
5. If the issue cannot be resolved, you can select a further course of action to pursue based on the available services listed in this chapter.

OEM or 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 current list of Woodward Business Partners is available at **www.woodward.com/directory**.

Product Service Options

Depending on the type of product, the following options for servicing Woodward products may be available through your local Full-Service Distributor or the OEM or Packager of the equipment system.

- 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 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.

Flat Rate Repair: Flat Rate Repair is available for many of the standard mechanical products and some of the electronic 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.

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. 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's Full-Service Distributors offer various Engineering Services for our products. For these services, you can contact the Distributor by telephone or by email.

- 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.

Product Training is available as standard classes at many Distributor locations. Customized classes are also available, which can be tailored to your needs and held at one of our Distributor 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 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 one of the Full-Service Distributors listed at **www.woodward.com/directory**.

Contacting Woodward's Support Organization

For the name of your nearest Woodward Full-Service Distributor or service facility, please consult our worldwide directory at **www.woodward.com/directory**, which also contains the most current product support and contact information.

You can also contact the Woodward Customer Service Department at one of the following Woodward facilities to obtain the address and phone number of the nearest facility at which you can obtain information and service.

Products Used in Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany:	
Kempen	+49 (0) 21 52 14 51
Stuttgart	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Products Used in Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Products Used in Industrial Turbomachinery Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (124) 4399500
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Technical Assistance

If you need to contact technical assistance, you will need to provide the following information. Please write it down here before contacting the Engine OEM, the Packager, a Woodward Business Partner, or the Woodward factory:

General

Your Name _____

Site Location _____

Phone Number _____

Fax Number _____

Prime Mover Information

Manufacturer _____

Engine Model Number _____

Number of Cylinders _____

Type of Fuel (gas, gaseous, diesel, dual-fuel, etc.) _____

Power Output Rating _____

Application (power generation, marine, etc.) _____

Control/Governor Information

Control/Governor #1

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Control/Governor #2

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Control/Governor #3

Woodward Part Number & Rev. Letter _____

Control Description or Governor Type _____

Serial Number _____

Symptoms

Description _____

_____

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.

Revision History

Changes in Revision M—

- Added Lockout/Tagout and I/O Lock warnings to Warnings section
- Updated Electrostatic Discharge Awareness section
- Updated Regulatory Compliance section
- Added mounting diagrams Figures 2-1a, 2-1b, 2-1c to Chapter 2
- Updated Figure 2-2 outline drawings in Chapter 2
- Added and updated various warnings throughout
- Updated Earth Ground section
- Swapped Chapter 5 and 6 and updated Chapter 5 Service Tool
- Updated Figures 4-1 through 4-4 in Chapter 4
- Increased Fuel Gas Temperature spec to 85 °C
- Changed Table 3-6 Fuel Gas Compound units to ppm and increased Hydrogen to (< 30%)
- Decreased Fuel Gas Differential spec to 30 mbar
- Increased Proof Pressure to 2.1 bar gauge
- Revised Declaration of Conformity and Declaration of Incorporation; added UKCA Declarations

Changes in Revision K—

- Updated Regulatory Compliance section
- Revised Declaration of Conformity and Declaration of Incorporation

Changes in Revision J—

- Revision advanced to coordinate with new installation sheet, and to update manual to latest formats and safety warnings.

Changes in Revision H—

- Corrected minimum burst pressure to 16.0 bar gauge

Changes in Revision G—

- Updated Figure 2-1 to correct dimensions on drawing

Declarations

EU DECLARATION OF CONFORMITY

EU DoC No.:	00244-04-EU-02-02.DOCX
Manufacturer's Name:	WOODWARD, INC.
Manufacturer's Contact Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Name(s)/Number(s):	TecJet 50 Plus, TecJet 85, TecJet 110, High Pressure TecJet
The object of the declaration described above is in conformity with the following relevant Union harmonization legislation:	Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC)
Applicable Standards:	
EMC	EN 61000-6-4:2007/A1:2011 : Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments EN 61000-6-2:2005/AC:2005; Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments

This declaration of conformity is issued under the sole responsibility of the manufacturer.
We, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s).

MANUFACTURER

Signature

Annette Lynch
Full Name

Engineering Manager
Position

Woodward, Fort Collins, CO, USA
Place

16-JUN-2022
Date

5-09-1183 Rev 37

DECLARATION OF INCORPORATION
Of Partly Completed Machinery
2006/42/EC

File name:	00244-04-EU-02-03
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Names:	TecJet 50 Plus, TecJet 85, TecJet 110, High Pressure TecJet
This product complies, where applicable, with the following Essential Requirements of Annex I:	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7

The relevant technical documentation is compiled in accordance with part B of Annex VII. Woodward shall transmit relevant information if required by a reasoned request by the national authorities. The method of transmittal shall be agreed upon by the applicable parties.

The person authorized to compile the technical documentation:

Name: Dominik Kania, Managing Director
Address: Woodward Poland Sp. z o.o., ul. Skarbowa 32, 32-005 Niepolomice, Poland

This product must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of this Directive, where appropriate.

The undersigned hereby declares, on behalf of Woodward Inc. of Loveland and Fort Collins, Colorado that the above referenced product is in conformity with Directive 2006/42/EC as partly completed machinery:

MANUFACTURER

Signature

Annette Lynch
Full Name

Engineering Manager
Position

Woodward Inc., Fort Collins, CO, USA
Place

16-JUN-2022
Date

Document: 5-09-1182 (rev. 21)

UKCA DECLARATION OF CONFORMITY

UKCA DoC No.: 00244-EU-UKCA-02-01
Manufacturer's Name: WOODWARD INC.

Manufacturer's Contact Address: 1041 Woodward Way
Fort Collins, CO 80524 USA

Model Name(s)/Number(s): TecJet 50 Plus, TecJet 85, TecJet 110, High Pressure TecJet

The object of this Declaration is in full conformity with the following UK Statutory Instruments (and their amendments):

S.I. 2016 No. 1091	Electromagnetic Compatibility Regulations 2016

The Object of this Declaration is in conformity with the applicable requirements of the following designated standards and technical specifications.

EN 61000-6-4:2007, EN 61000-6-4:2007/A1:2011	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
EN 61000-6-2:2005, EN 61000-6-2:2005/AC:2005	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments

This declaration of conformity is issued under the sole responsibility of the manufacturer
We, the undersigned, hereby declare that the equipment specified above conforms to the above Regulation(s).

MANUFACTURER

Signature

Annette Lynch
Full Name

Engineering Manager
Position

Woodward, Fort Collins, CO, USA
Place

16-JUN-2022
Date

DECLARATION OF INCORPORATION
Of Partly Completed Machinery
S.I. 2008 No. 1597

File name:	00244-EU-UKCA-02-02
Manufacturer's Name:	WOODWARD INC.
Manufacturer's Address:	1041 Woodward Way Fort Collins, CO 80524 USA
Model Names:	TecJet 50 Plus, TecJet 85, TecJet 110, High Pressure TecJet
This product complies, where applicable, with the following Essential Requirements of Annex I:	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7

The relevant technical documentation is compiled in accordance with part B of Annex VII. Woodward shall transmit relevant information if required by a reasoned request by the national authorities. The method of transmittal shall be agreed upon by the applicable parties.

The person authorized to compile the technical documentation:

Name: Andy Marshall, General Manager at Woodward Prestwick
Address: 5 Shawfarm Road, Prestwick, Ayrshire, Scotland, United Kingdom KA9 2TR

This product must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of this Directive, where appropriate.

The undersigned hereby declares, on behalf of Woodward Inc. of Loveland and Fort Collins, Colorado that the above referenced product is in conformity with Regulation S.I. 2008 No. 1597 as partly completed machinery:

MANUFACTURER

Signature

Annette Lynch

Full Name

Engineering Manager

Position

Woodward Inc., Fort Collins, CO, USA

Place

16-JUN-2022

Date

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 26185.

B 2 6 1 8 5 : M

PO Box 1519, Fort Collins CO 80522-1519, USA
1041 Woodward Way, Fort Collins CO 80524, USA
Phone +1 (970) 482-5811

Email and Website—www.woodward.com

Woodward has company-owned plants, subsidiaries, and branches, as well as authorized distributors and other authorized service and sales facilities throughout the world.

Complete address / phone / fax / email information for all locations is available on our website.