WOODWARD

Product Manual 40157
(Revision A)
Original Instructions

3171A Gas Valve and TM-100i Actuator

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 *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

www.woodward.com/publications

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 *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, 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 Out-of-date translations are marked with ⚠.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.

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Important Definitions

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

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

⚠WARNING

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.

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. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

Chapter 1.
General Information

General

The TM-100i/3171A gas valve is designed for metering gaseous fuel to industrial and marine gas turbine engines. The TM-100i actuator is used to drive the 3171A gas valve, closed loop to position demand. Valve position feedback is provided by a resolver directly coupled to the valve metering sleeve. Having the feedback on the valve prevents errors in the valve position due to windup in the actuator and valve linkage, and makes replacement of the actuator in the field possible. Closed loop position control is accomplished through a TM-100 digital driver. The assembly is failsafe to close upon loss of either electrical or hydraulic power.

3171A Gas Valve

The 3171A gas valve is a stainless steel valve capable of metering gas flow between 0 and 20 000 lb/h (0 and 9072 kg/h). The valve is designed to bolt into a two-inch (51 mm) line by means of 0.625-11 UNC 2B tapped holes. The flange is Class 600 per ANSI B16.5. The valve design is a rotary metering sleeve and a shoe-type throttling valve. The valve shoe is spring and pressure loaded against the metering port to minimize leakage and to self-clean the metering port. Metering port area is determined by input shaft positioning from the actuator. The valve has an internal spring to return the valve to the minimum fuel position in the event of a power loss to the actuator.

The 3171A valve has redundant seals on all dynamic sealing surfaces. Between these two seals is an overboard vent which vents any gasses that may leak past the first seal to a safe vent location. The use of an inner-seal vent prevents the second dynamic seal from seeing any differential pressure and thus offers protection from the leakage of gasses from the valve into the surrounding ambient atmosphere.

The valve design incorporates an inlet guide tube to condition the inlet flow and to direct any gas contaminants through the metering port, minimizing any accumulation in the valve housing. The metering sleeve support bearings are positively sealed from the gas. Internal valve parts are made of through-hardened stainless steel.

TM-100i Actuator

The TM-100i actuator is a rotary output, electrohydraulic, integrating actuator, designed to position rotary valves with very high accuracy and fast response to meet the requirements of large engine and steam turbine control systems. It is suitable fur use in hazardous environments as defined in the National Electrical Code as Class I, Groups C & D, Divisions 1 and 2. The actuator requires a hydraulic supply regulated so between 500 and 1000 psig (3448 and 6895 kPa), able to supply at least 0.5 US gal/min (1.9 L/min) of oil, fuel or hydraulic fluid steady state and 2.8 US gal/min (10.6 L/min) transient. Oil filtration should be ISO DIS 4406 code 16/13 or better.

Fluid enters the actuator via a 40 µm nominal last-chance protective filter and passes to the torque motor servovalve which also has a filter for the fluid going to the torque motor's jet pipe.

The assembly incorporates a dual coil torque motor servovalve, a spool-type control valve, and an equal-area output stage piston with internal linkage connecting it to the rotary output shaft. Minimum and maximum position stops are integrated into the actuator assembly to allow for minimum and maximum fuel flows to be set as well as preventing the actuator from being able to overdrive the valve.

The torque motor has nominal null current of 20 mA (10 mA in each coil when wired in parallel). This positive null current will drive the valve to the closed position on lost of electrical signal. Full scale flow from the torque motor servovalve to the output servopiston is ±140 mA off the null current (±70 mA when wired in parallel).

The actuator is constructed of an anodized aluminum housing with through-hardened stainless steel internal parts. All static seals are viton seals, and dynamic seals are unfilled Teflon.

Resolver

Valve position feedback for closed-loop position control is accomplished using a brushless resolver. The resolver is directly coupled to the valve metering shaft through the use of a stainless steel bellows coupling. Either single or dual resolvers may be used with the valve assembly. The resolver receives its excitation from the TM-100 digital driver. The TM-100 driver uses a resolver-to-digital converter to determine the valve position using the output voltages from the resolver's two secondary windings. Resolver accuracy is ±0.05°.

Chapter 2.
Installation

Unpacking

Be careful when unpacking the TM-100 driver and TM-100i actuator/3171A gas valve. Check the devices for signs of damage such as a bent or dented case and loose or broken parts. If damage is found, notify the shipper immediately. The devices may be stored in their original shipping containers until they are ready for installation. Protect the devices from weather and from extreme humidity or temperature fluctuations during storage.

Power Requirements

The TM-100i actuator receives all of its power from the TM-100 driver. The torque motor has a null current of 20 ±2 mA and operates ±140 mA off null.

TM-100i Actuator/3171A Gas Valve Installation

Make sure that adequate room is allowed for required wiring and that the wiring and valve/actuator are accessible for service.

To install the TM-100 actuator/3171A gas valve, follow the steps below:

1. Remove the protective covers from the valve flanges. See Figure 2-1 for overall dimensions, installation hole locations, and any fitting or plumbing connections. Installation attitude does not affect valve/actuator performance.

2. Using appropriate gasket material (suitable for the pressure and temperature of the application), install the valve into the system as close to the engine fuel manifold as practicable. There is an arrow on the valve that indicates flow direction for installation. The valve body is tapped for 0.625-11 UNC studs or bolts. All eight (8) studs must be used for proper installation. For most applications, the valve/actuator assembly can be supported by the two inch (51 mm) flanges when bolted into the system piping. For applications where this is not practicable or where additional support is required, the assembly can be bolted to a supporting structure by the four 0.625-11 UNC-2B tapped holes in the valve base. For high vibration environments (>3 G), support of both the actuator and valve is required.

3. Install and tighten all mounting hardware. For all 0.625-II UNC bolts, torque to the appropriate values fur the type of fasteners used in the installation. See Figure 2-2 for the recommended torque pattern.

4. Connect the interseal vent to the system gas vent. The vent connection is a 0.562-18 UNF straight thread O-ring connection. See Figure 2-1.

NOTICE **DO NOT plug both the interseal vents. This can cause pressure to build up in the vent cavity and may potentially damage the valve.**

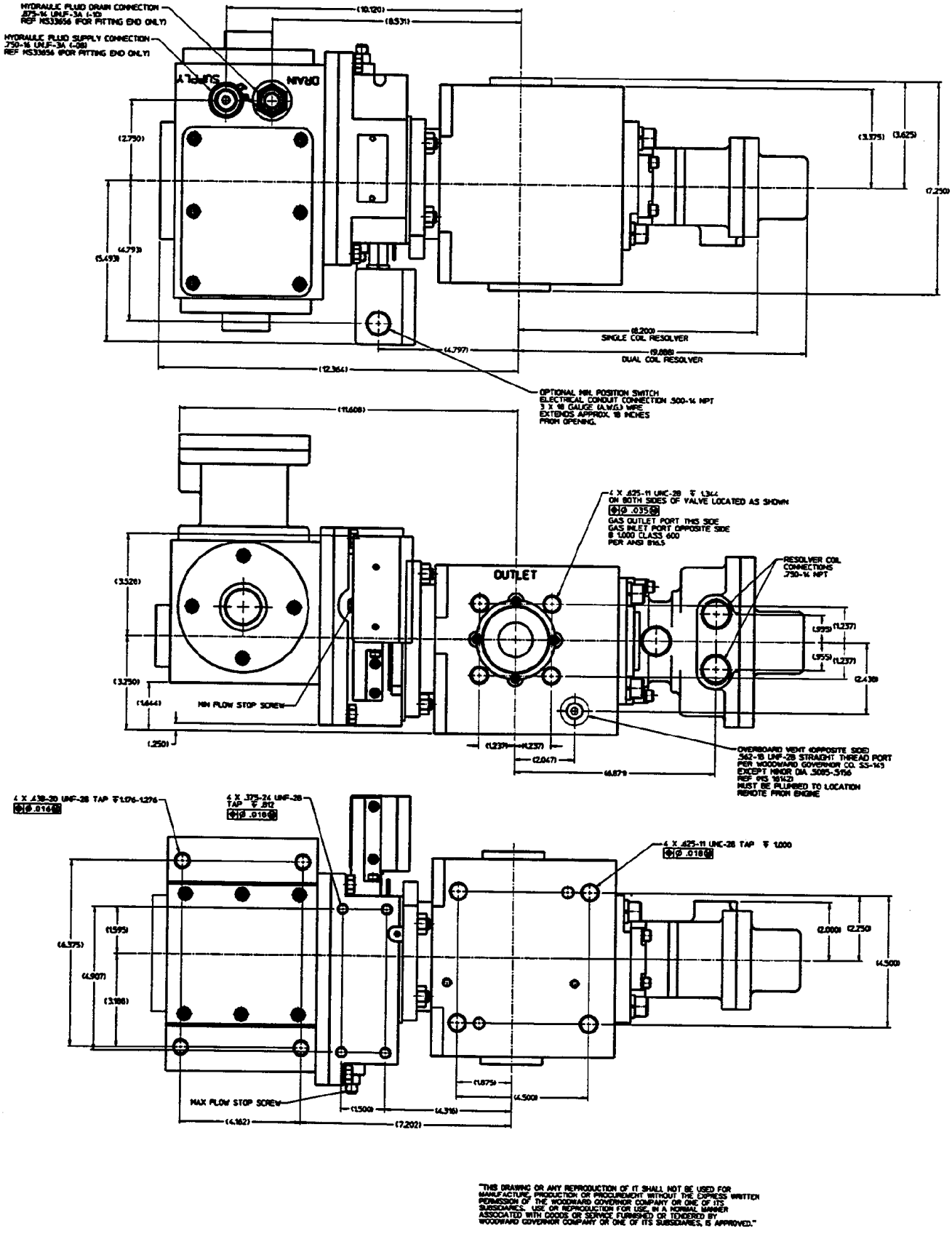


Figure 2-1. TM-100i Actuator/3171A Gas Valve Outline Drawing

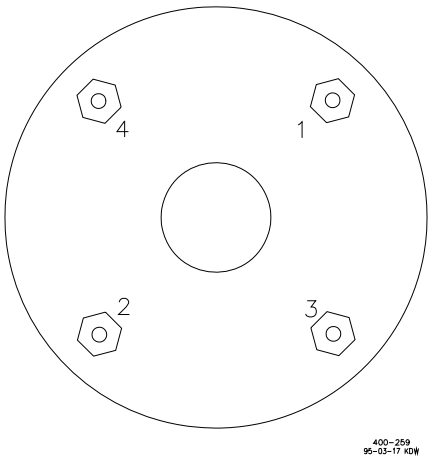


Figure 2-2. Recommended Torque Pattern

5 After the valve is installed in the piping system, the piping connections should be checked for any leaks. Use water, air, or inert gas to check.

6. Remove the protective caps from the hydraulic supply and drain fittings.

7. Connect the actuator hydraulic supply and drain. Hydraulic oil should be filtered to ISO DIS 4406 code 16/13 or better (10 µm minimum). The actuator hydraulic supply and drain fittings are 37° flare fittings size (-08) and (-10) respectively. The supply fillings contains a 40 µm nominal last-chance filter, and the drain fitting contains a flame trap. These fittings are functionally necessary to allow the actuator to meet its hazardous location rating.

NOTICE

Replacement of the actuator inlet or outlet fitting, or the removal of their internal components, will void the actuators' hazardous location environmental listing.

IMPORTANT

It is recommended that the end of the line (outside the enclosure) be placed in a small container of clean, lightweight oil to check for gas leakage. This will also prevent a corrosive or salt air atmosphere from corroding the shaft bearings which are in the cavity between the shaft seals.

8. Refer to the electrical connections section for wiring instructions.

Electrical Connections

Shielded Wiring

All shielded cable must be twisted conductor pairs with either a foil or a braided shield. All signal lines should be shielded to prevent picking up stray signals from adjacent equipment. Connect the shields as shown in the plant wiring diagram (Figures 2-3 through 2-10). Wire exposed beyond the shield muss not exceed two inches (50 mm). The other end of the shield muss be left open and insulated from any other conductor. Do not run shielded signal wires with other wires carrying large currents. See manual 50532, *EMI Control for Electronic Governing Systems*, for more information.

Installations with severe electromagnetic interference (EMI) may require shielded cable run in conduit, double shielded wire, or other precautions. Contact Woodward for more information.

Plant Wiring

Figures 2-3 through 2-10 are the plant wiring diagrams for the TM-100 digital driver, TM-100i actuator/3171A gas valve when conduit is being used. If conduit is not being used, the single wires from the driver to the FTM must be multi-conductor shielded wires. The wiring between the TM-100 driver and the feedback resolver must be limited to 100 ft (30 m) and must be low capacitance (14 pF/ft or 46 pF/m) cable. Contact Woodward for available sources of low capacitance wire.

The metering valve is not shipped with any field wiring attached (such as pigtails), but rather is provided with internal terminal blocks for field wiring. These terminal blocks are located under the explosion-proof covers on the actuator and resolver housing. The actuator housing has two 0.5 inch NPT taps, and the resolver housing has two 0.75 NPT taps. To wire the torque motor, remove the six 0.250-28 socket-head cap screws with a 3/16 Allen wrench.

The actuator wires for the torque motor may go through either NPT tap. The torque motor servovalve is a dual coil device. For maximum protection against wiring faults, the wiring for each coil should be run through its own conduit. To wire the resolver(s), remove the four 0.250-28 socket-head cap screws with a 3/16 Allen wrench. See “Terminal Blocks” below for information on the use of terminal blocks.

There is one conduit for each resolver wire set for the valve. If you have a dual feedback resolver, one set of wires should be run through each conduit opening. If you have only a single feedback resolver then either conduit may be used. The unused conduit should be plugged with a conduit plug that meets the requirements of the installation. See “Terminal Blocks” below for information on the use of terminal blocks.

NOTICE

Take special care to avoid contact with the resolver when wiring. Moving the resolver will result in a loss of valve calibration.

NOTICE

The mating surfaces between the torque motor and the resolver covers are critical to maintain the unit’s explosion-proof listing. Any damage to either of these surfaces will void the unit’s hazardous location listing. If either of these surfaces are damaged during wiring, the valve must be returned for repair.

IMPORTANT

Since there are two available versions of the TM-100 driver (single feedback and dual feedback), refer only to the diagrams for your version.

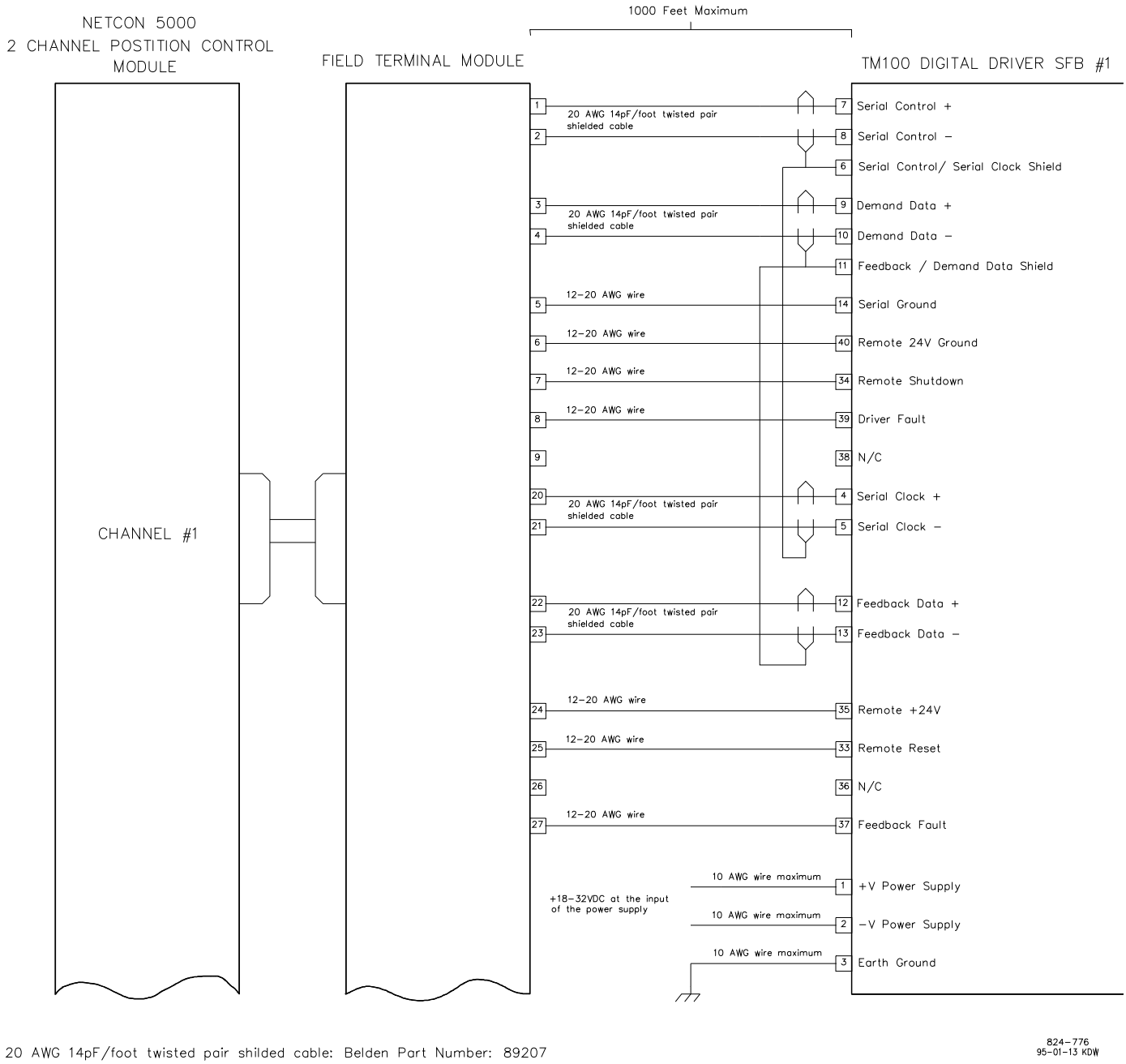


Figure 2-3. Channel 1, Single Feedback

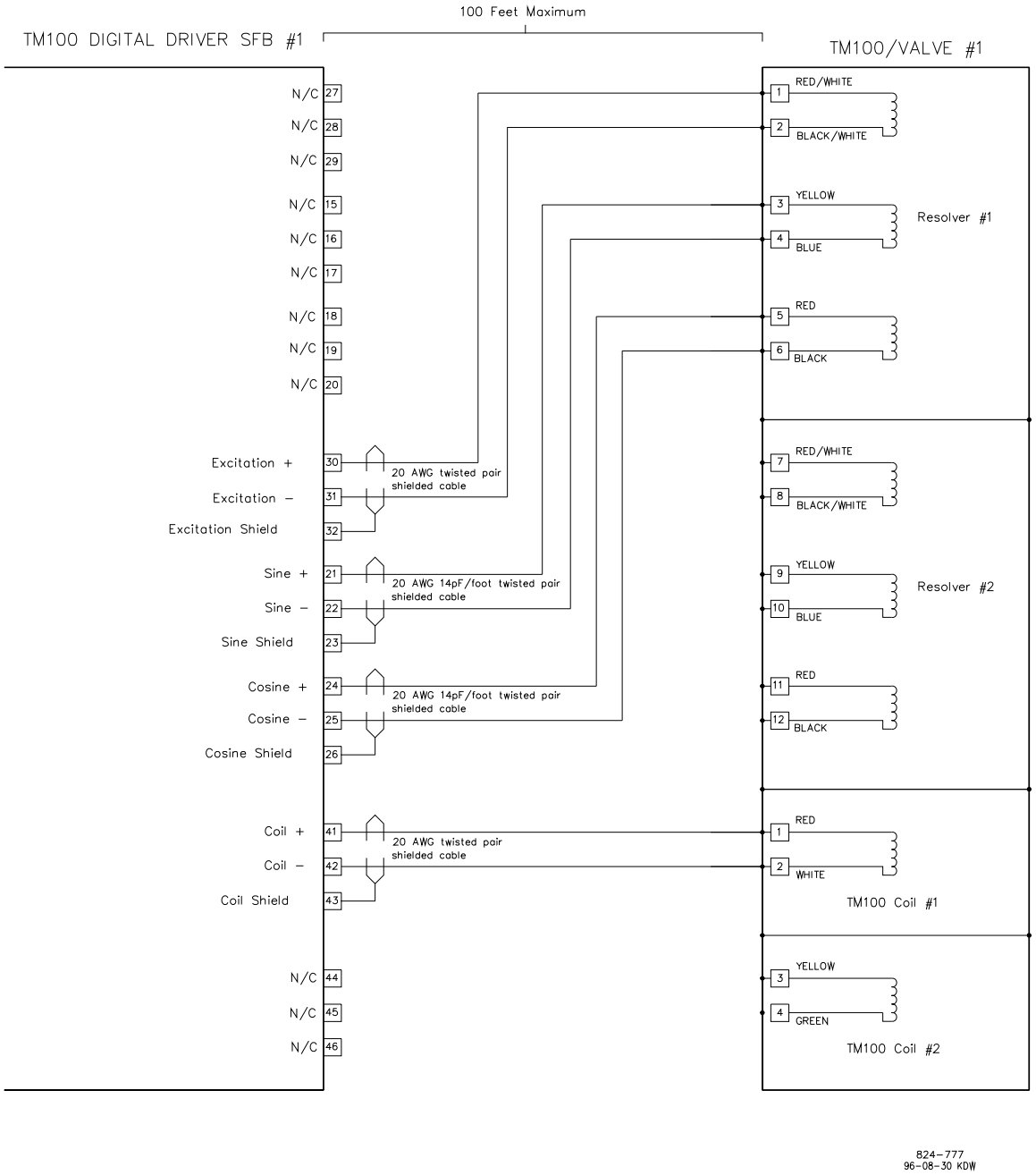
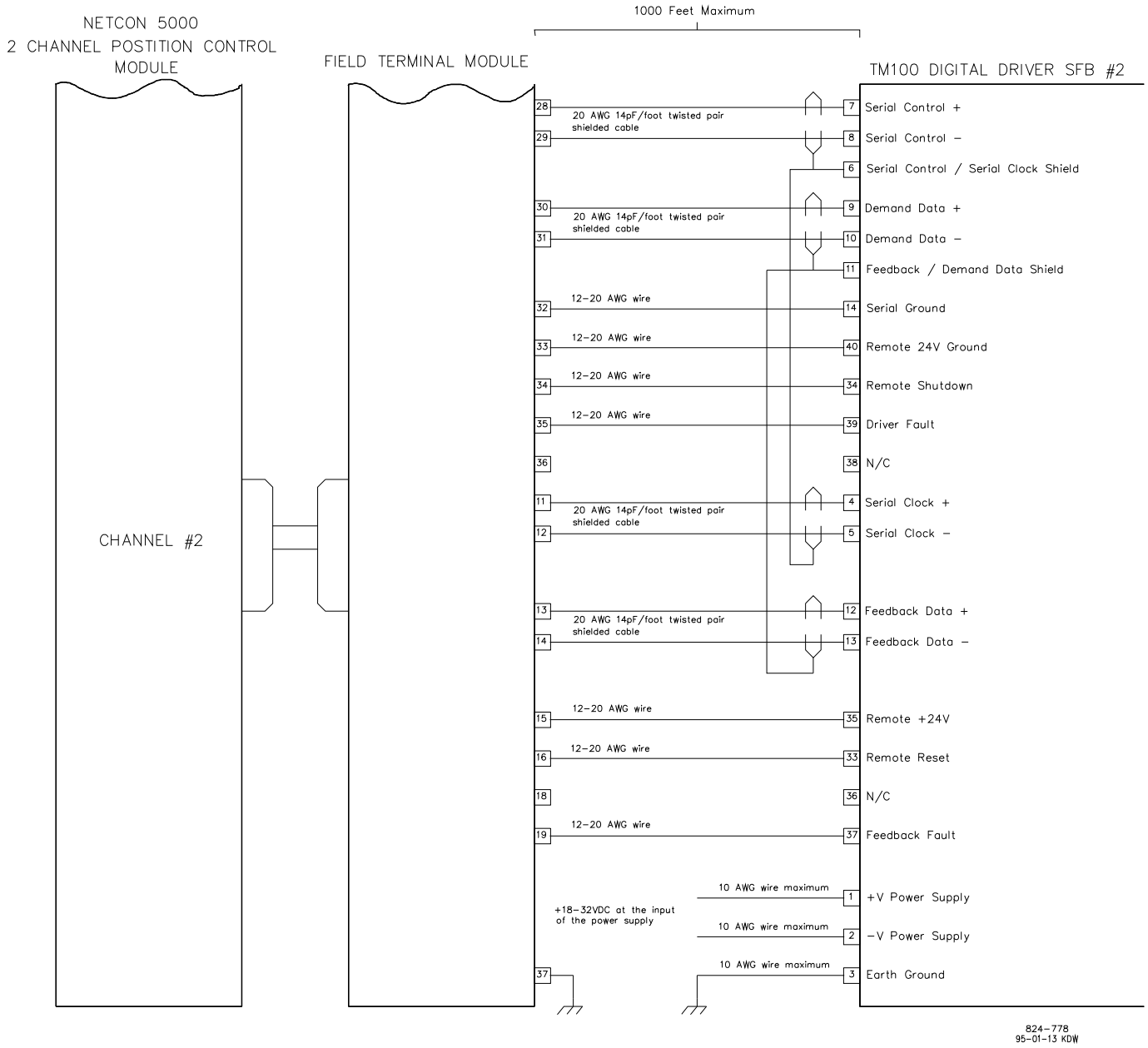


Figure 2-4. Channel 1, Single Feedback



20 AWG 14pF/foot twisted pair shilded cable: Belden Part Number: 89207

Figure 2-5. Channel 2, Single Feedback

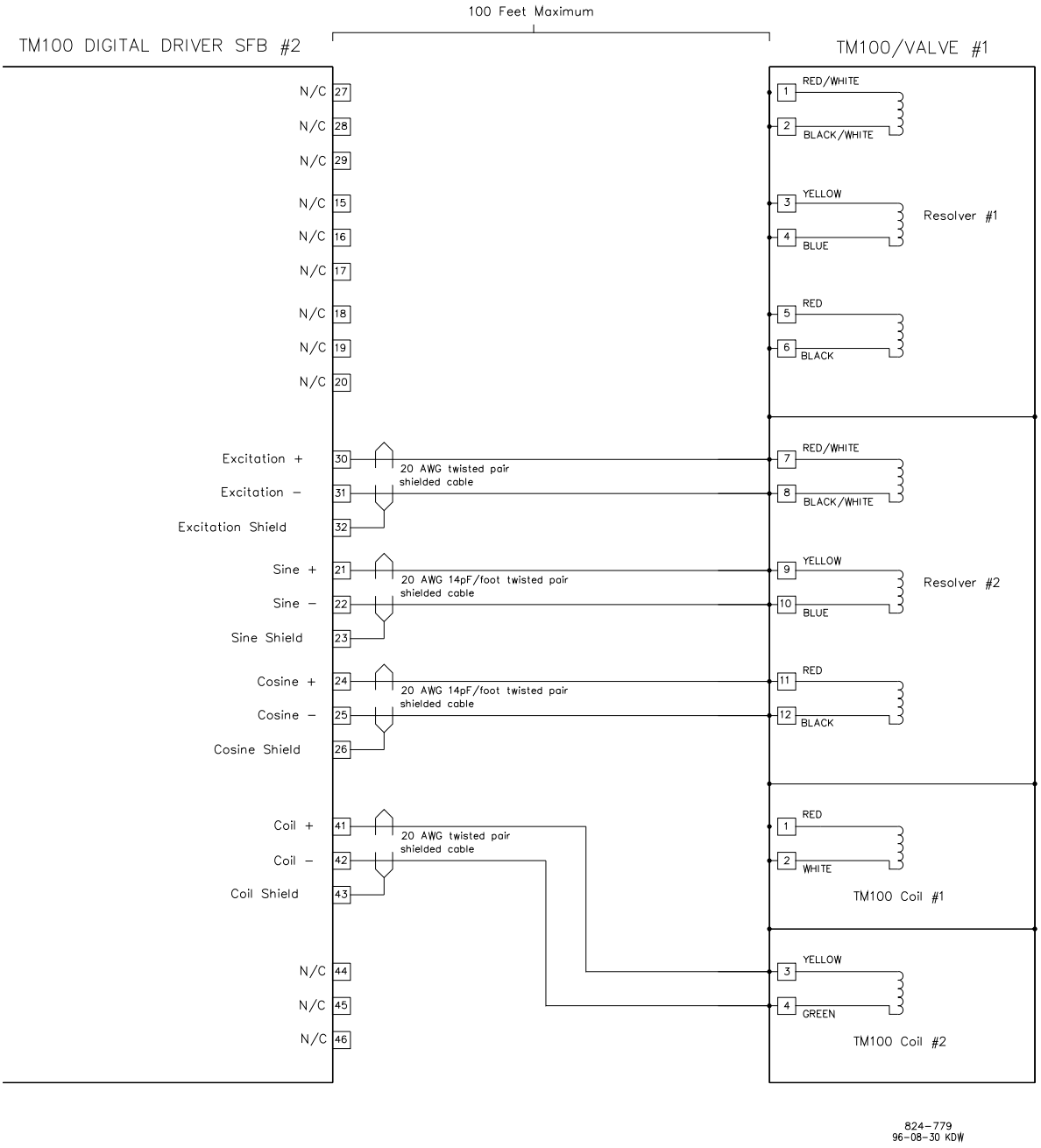


Figure 2-6. Channel 2, Single Feedback

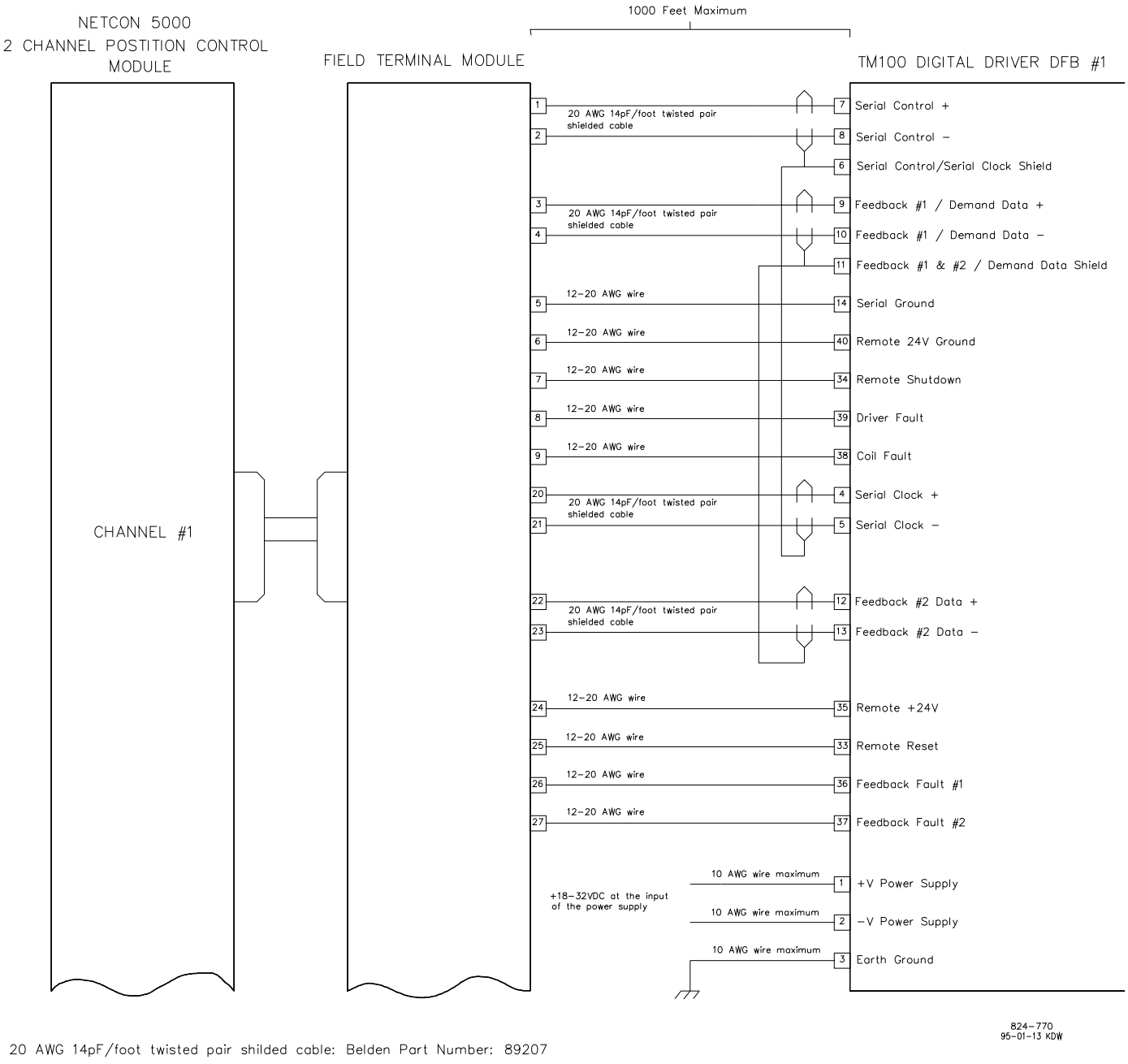


Figure 2-7. Channel 1, Dual Feedback

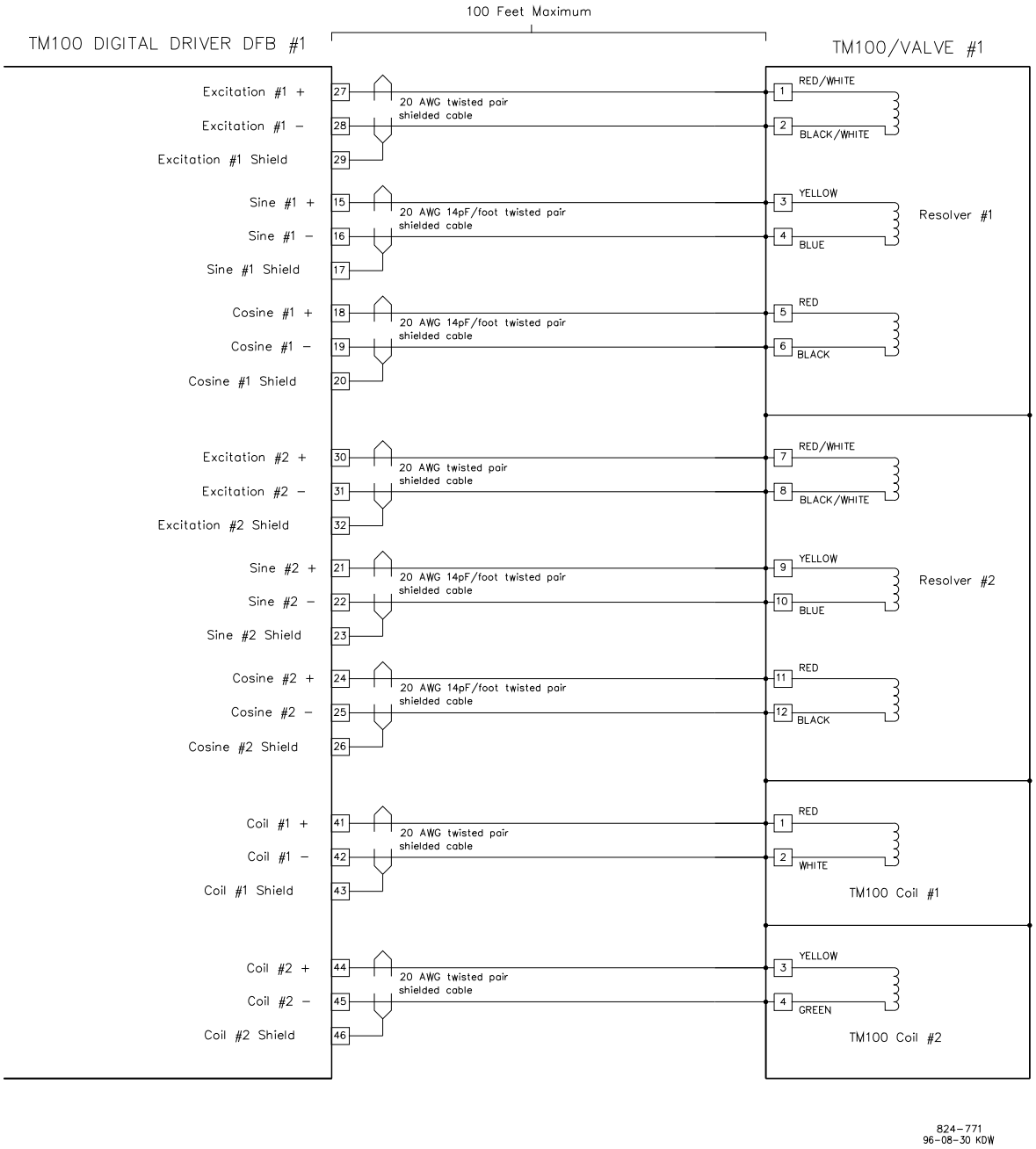


Figure 2-8. Channel 1, Dual Feedback

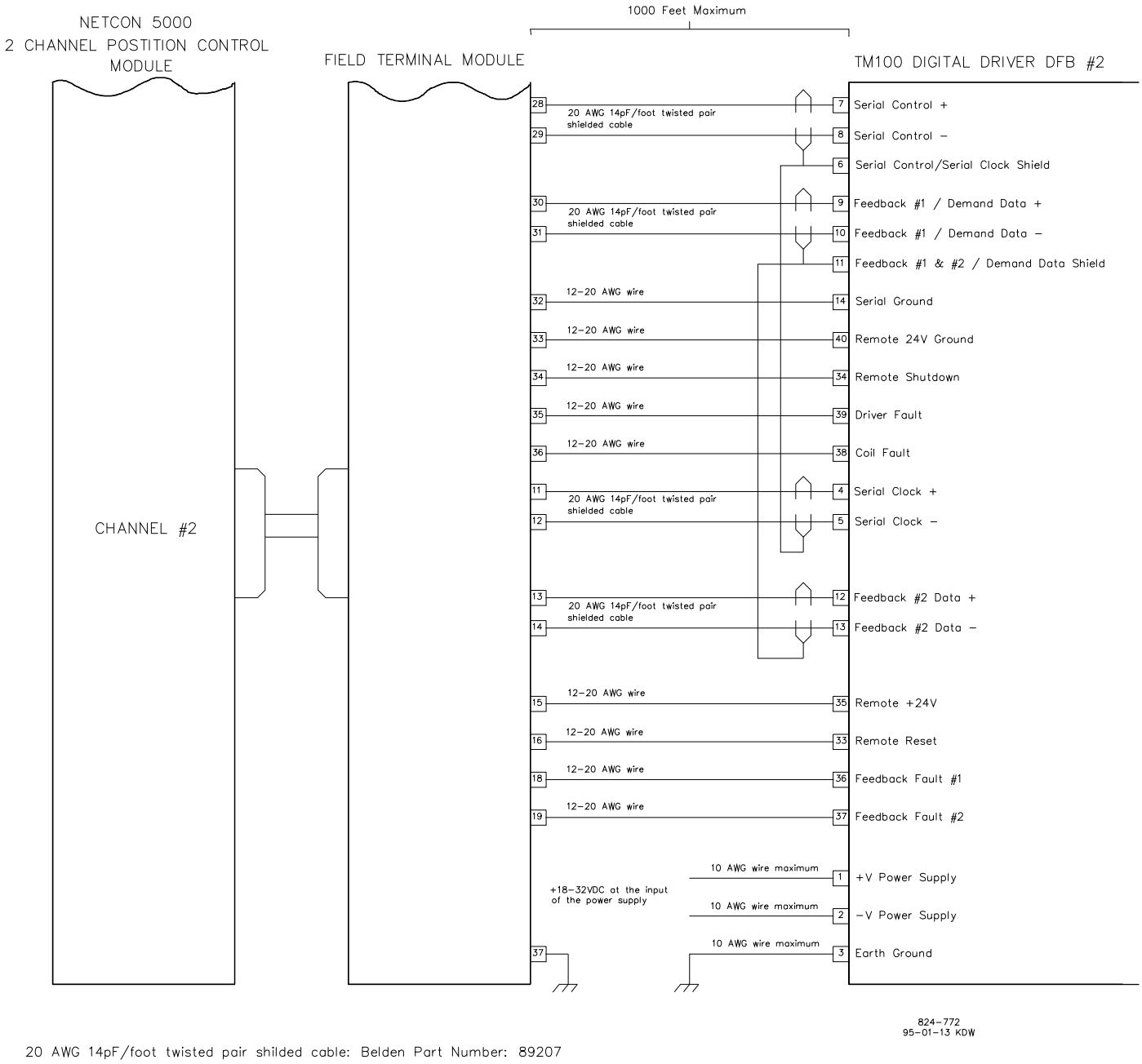


Figure 2-9. Channel 2, Dual Feedback

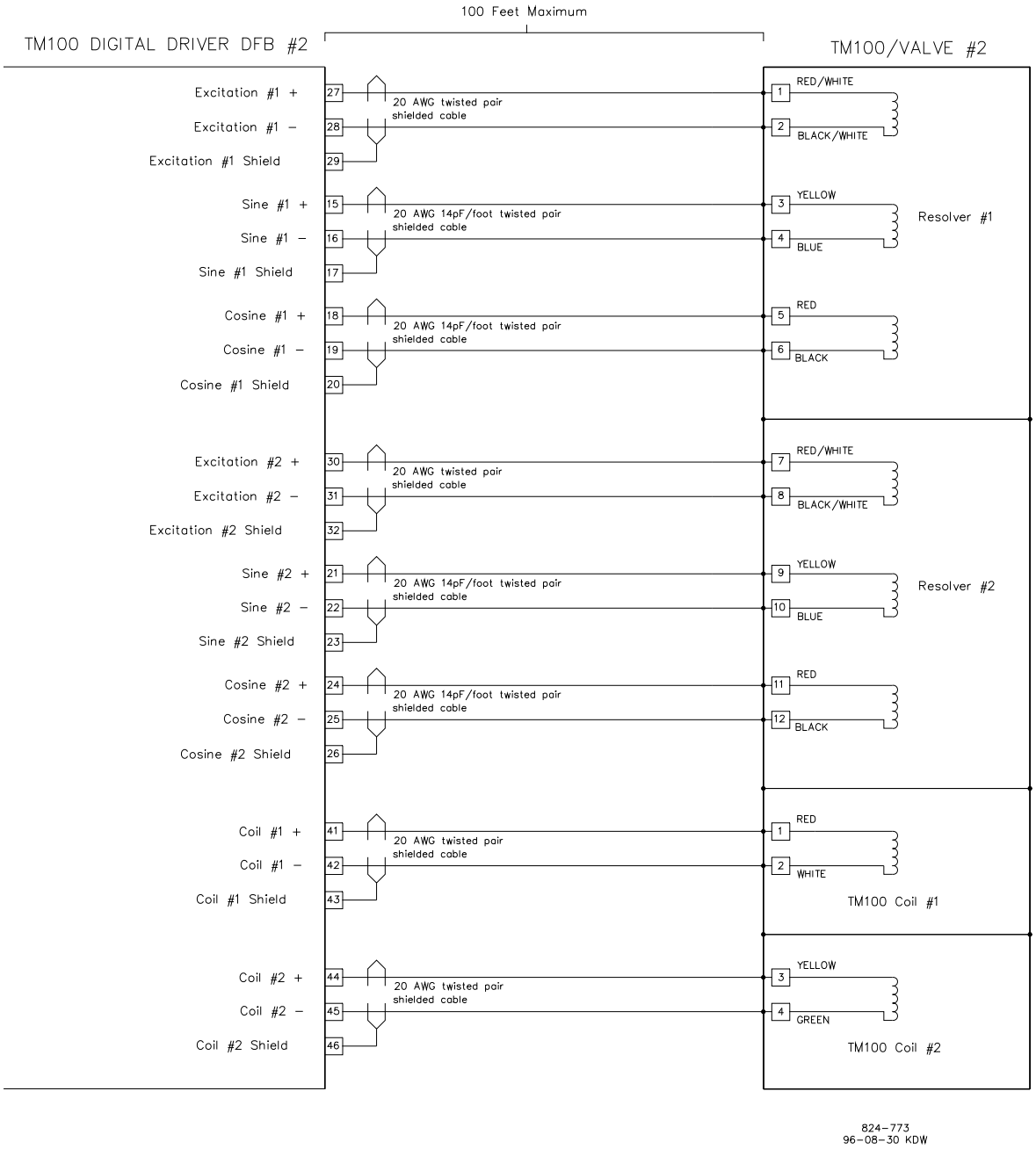


Figure 2-10. Channel 2, Dual Feedback

Terminal Blocks

The terminal blocks provided for the motor sense wires and the resolver are WAGO 264 series. These terminal blocks are top load terminal blocks and are actuated by inserting a DIN 5264 screwdriver into the opening behind the wire slot. Once the cage clamp has been opened, the wire can be inserted and the screwdriver removed. Please see the illustration and instructions below.

1. The screwdriver is inserted into the operating slot up to the stop.

2. The screwdriver blade holds the clamping spring open automatically so that the conductor can be introduced into the clamping unit.

3. The screwdriver is withdrawn. The conductor is automatically clamped.

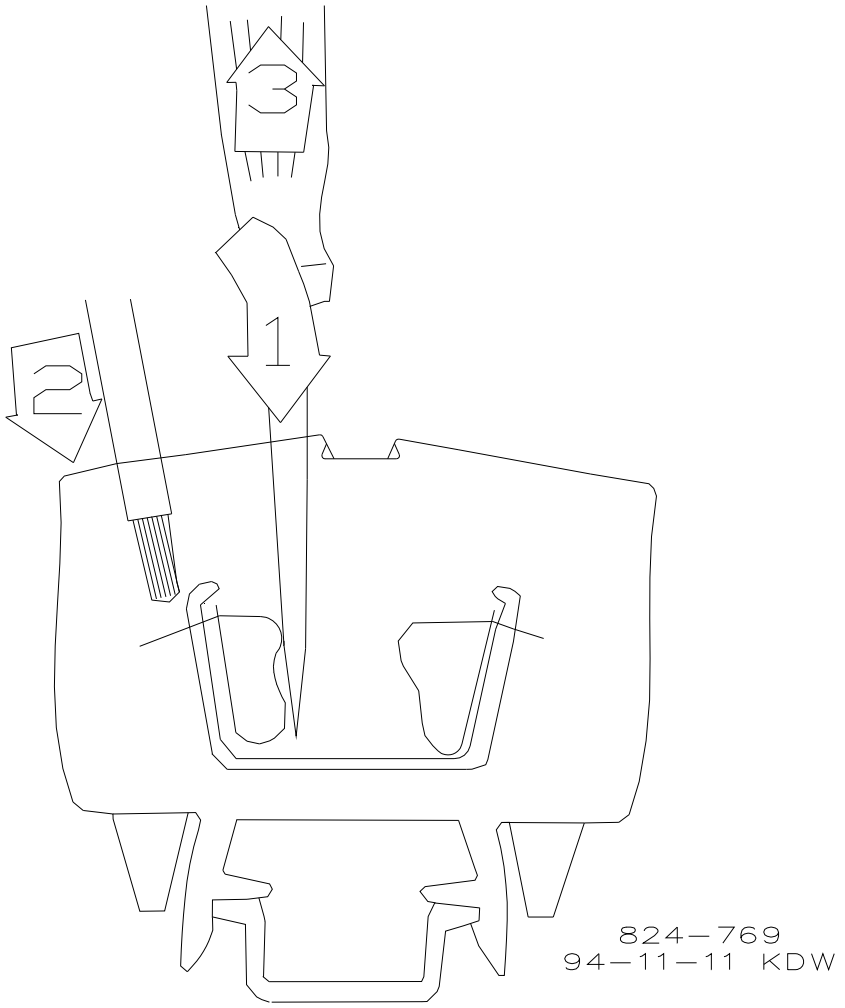


Figure 2-11. WAGO 264 Series Terminal Block

Chapter 3.
Description of Operation

TM-100i Actuator

The integrating actuator is used with an electronic position control circuit (see Figure 3-1) which compares position demand (V_C) and feedback (V_K) signals, and outputs a torque motor current to correct any position errors. When the actuator output shaft is stationary, torque motor current is at the null value. Any change in position demand voltage will result in a change in the coil current until the actuator moves to the new required position. When position demand is increased, there will be a positive position error causing a rise in torque motor current.

The essential element of the TM-100 is the torque motor servovalve which uses a jet pipe hydraulic amplifier to generate a differential pressure to operate the second stage spool valve. The torque motor receives dc current signals from the electric control and applies a torque to the armature/jet pipe assembly supported by a thin-walled flexure tube. The movement of the armature/jet pipe assembly diverts more fluid through one receiver hole relative to the other. The difference in flow and pressure between the two receivers is carried through to one spool end, causing displacement of the spool. Movement of the spool opens the supply pressure port (P_S) to one control port and return port (P_d) to the other control port. The spool motion also carries the ball end of the feedback spring, creating a restoring torque on the armature/jet pipe assembly. Once the restoring torque becomes equal to the torque from the magnetic forces, the armature/jet pipe assembly moves back to the neutral position, and the spool is held open in a state of equilibrium until the input signal changes to a new level.

Flow from the spool valve is transmitted via internal passages to the ends of the power piston. The linear movement of the power piston is converted into rotary motion to the output shaft through internal linkage. Movement of the output shaft results in valve position through a 1:1 linkage.

3171A Gas Valve

Actuator output shaft movement positions the gas valve metering sleeve and resolver. Gas flow is metered at the valve through a ported rotary sleeve. Gas enters the inlet port (P1) where it is directed through the inlet guide tube to the rotary metering port. A spring and pressure loaded, sharp-edged shoe seals against the metering sleeve. Metered fuel is discharged at the outlet pressure. Metered fuel is determined by valve position, inlet pressure (P1), outlet pressure (P2), gas temperature, and gas composition.

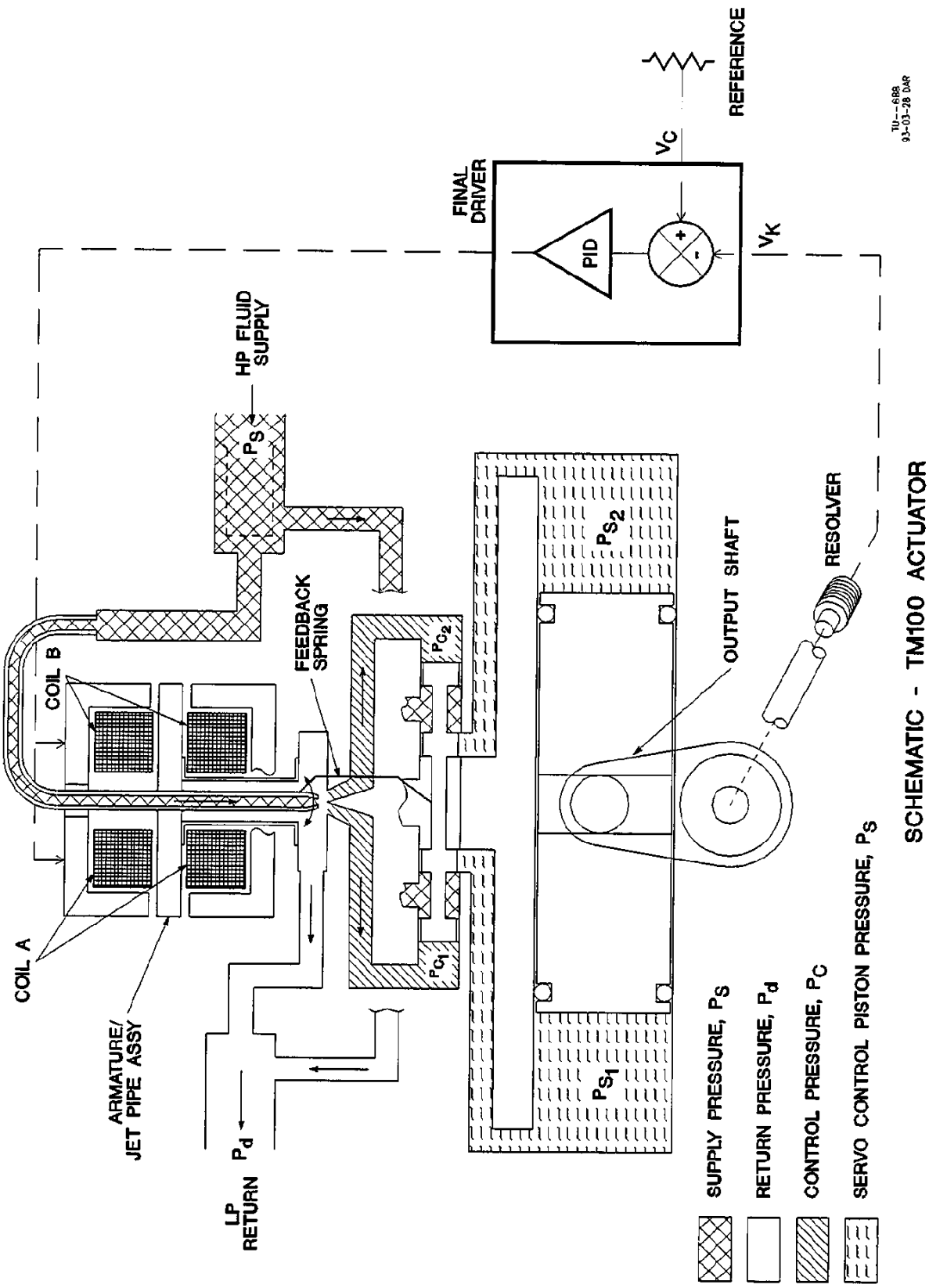


Figure 3-1. Schematic, TM-100 Actuator

Chapter 4.
Actuator/Valve Calibration

The TM-100i actuator/3171A gas valve is typically used in applications that require extremely high accuracy, like dry low emissions (DLE) control. For that reason, all calibration of the actuator/valve assembly is performed at the factory.

The mechanical stops on the valve are non-functional. Flow calibration is achieved using the digital resolver feedback and a valve characterization table. The flow vs. angle data is determined for each valve during the flow testing and is recorded on a floppy disk.

⚠WARNING

Significant turbine damage, high emissions levels, release of high temperature gas, fire, damage to nearby equipment, injury to personnel, or death may result from incorrect fuel valve calibration. To correctly operate the fuel metering valve(s), the NetCon® controller must be programmed with the correct valve characterization curve for the specific valve being used. Woodward provides the programming information to the valve purchaser in the form of a data file specifically identified by the valve serial number and date. The supplier of the application program must incorporate the valve characterization data file into the application program by following the procedure described in this manual. Failure to follow the procedure herein, or any non-Woodward alteration (including attempt to repair), or damage to the valve, may result in a change of characteristics leading to the same potential hazards.

⚠WARNING

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.

Following is the procedure for downloading the correct valve characterization information to the NetCon control.

IMPORTANT

This procedure is intended for use by qualified engineering personnel only. Familiarity with the use of Woodward GAP™ programming is required.

1. Obtain the serial number and calibration date of the fuel metering valve that is being used on the system. These are located on the nameplate and date sticker on the valve assembly.
2. Obtain the valve characterization data file for the valve in number one above from Woodward. The valve characterization file name and the valve serial number must match. The date on the valve and the date on the data file must match. If either of these items do not match, DO NOT continue with this procedure. Contact Woodward.
3. Rename this file to FMV.VLV, and place this file in the same directory as the <application filename> .CDR file, and recode the program using the Woodward GAP coder.
4. Install this application in the NetCon controller CPU, and enter the service mode. Go to the prompt “FMV S/N Verification”. Follow the steps under this category to verify that the valve serial number and the valve data file match. Operator confirmation of this match will be a permissive to run the engine.

Chapter 5. Troubleshooting

General

Faults in the governing system are usually revealed as speed variations of the prime mover, but it does not necessarily follow that such speed variations indicate governing system faults. Therefore, when improper speed variations appear, check all components including the prime mover for proper operation.

Field Repairs

Since the calibration is between the valve and the resolver, it is possible to replace the actuator in the field without the loss of calibration. Failures of the resolver will most likely result in the unit having to be recalibrated at the factory. Consuls a qualified Woodward service facility for more information.

Chapter 6. Specifications

Output Type	Rotary actuator and valve, limited rotation with adjustable minimum and maximum stops

General

Maximum Valve Travel	45°
Positional Feedback	Single or dual resolver (standard) Single RVDT (optional)
Gas Operating Pressures	O to 600 psia (0 to 4137 kPa) standard 0 to 900 psia (0 to 6206 kPa) optional
Gas Flow Range	25 to 20 000 lb/h (11 to 9072 kg/h)

(maximum gas flow depends on port design and ΔP across valve)

Hydraulic Requirements

Supply Pressure Range	400–1000 psig (2758 to 6895 kPa)
Design Pressure	750 psig (5171 kPa)
Proof Pressure	1500 psig (10 342 kPa)
Burst Pressure	2500 psig (17 238 kPa)
Flow Rate Requirements:	
Steady state @ 750 psi supply	0.30 US gal/min (1.1 L/min)
Steady state @ 1000 psi supply	0.35 US gal/min (1.3 L/min)
Transient flow	3.00 US gal/min (11.36 L/min)
Displaced Volume	1.48 in³ (24.26 mm³)

Electric

TM-100 Driver Power Requirements	44 W @ 24 Vdc (18–32 Vdc)
Current Driver	20 mA null ±140 mA
Actuator Coil Resistance	10 Ω per coil (dual coil standard)

Performance (@750 psig)

Position Accuracy	<±0.10° (w/ resolver feedback) <±0.50° (RVDT)
Stew Times:	
Increasing Flow Direction	>600°/s
Decreasing Flow Direction	>600°/s
Position Loop Bandwidth	>5 Hz fro commands from 0.1% to 5% of full stroke

Environmental

Operating Temperature Range	–40 to +300 °F (–40 to +149 °C)
Vibration	10 G maximum, 0 to 2000 Hz, 0.100” (2.54 mm) maximum amplitude
Shock	20 G maximum
Hazardous Location	Class I, Division 1, Groups C & D

Interface Information

3171A Valve Piping Connections	1”, 600 lb flanges per ANSI B16.5
3171A Valve Vent Connections	0.562-18 UNF (-06)
Resolver Wiring Connections	0.75 NPT conduit
TM-100 Wiring Connections	0.50 NPT conduit
TM-100 Hydraulic Supply	0.750-16 UNF (-08) ref. MS33656
TM-100 Hydraulic Drain	0.875-14 UNF (-10) ref. MS33656
Total Weight	92 lb (42 kg)

Chapter 7.
Service Options

Product Service Options

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

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

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

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

- A **Full Service Distributor** has the primary responsibility for sales, service, system integration solutions, technical desk support, and aftermarket marketing of standard Woodward products within a specific geographic area and market segment.
- An **Authorized Independent Service Facility (AISF)** provides authorized service that includes repairs, repair parts, and warranty service on Woodward's behalf. Service (not new unit sales) is an AISF's primary mission.
- A **Recognized Engine Retrofitter (RER)** is an independent company that does retrofits and upgrades on reciprocating gas engines and dual-fuel conversions, and can provide the full line of Woodward systems and components for the retrofits and overhauls, emission compliance upgrades, long term service contracts, emergency repairs, etc.
- A **Recognized Turbine Retrofitter (RTR)** is an independent company that does both steam and gas turbine control retrofits and upgrades globally, and can provide the full line of Woodward systems and components for the retrofits and overhauls, long term service contracts, emergency repairs, etc.

You can locate your nearest Woodward distributor, AISF, RER, or RTR on our website at:

www.woodward.com/directory

Woodward Factory Servicing Options

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

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

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

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

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

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

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

Returning Equipment for Repair

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

When shipping the item(s), attach a tag with the following information:

- return authorization number;
- name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part number(s) and serial number(s);
- description of the problem;
- instructions describing the desired type of repair.

Packing a Control

Use the following materials when returning a complete control:

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

NOTICE

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

Replacement Parts

When ordering replacement parts for controls, include the following information:

- the part number(s) (XXXX-XXXX) that is on the enclosure nameplate;
- the unit serial number, which is also on the nameplate.

Engineering Services

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

- Technical Support
- Product Training
- Field Service

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

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

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

For information on these services, please contact us via telephone, email us, or use our website: **www.woodward.com**.

How to Contact Woodward

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

Electrical Power Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (0) 21 52 14 51
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
Poland	+48 12 295 13 00
United States	+1 (970) 482-5811

Engine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
Germany	+49 (711) 78954-510
India	+91 (129) 4097100
Japan	+81 (43) 213-2191
Korea	+82 (51) 636-7080
The Netherlands	+31 (23) 5661111
United States	+1 (970) 482-5811

Turbine Systems

Facility	Phone Number
Brazil	+55 (19) 3708 4800
China	+86 (512) 6762 6727
India	+91 (129) 4097100
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

You can also locate your nearest Woodward distributor or service facility on our website at:

www.woodward.com/directory

Technical Assistance

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

Your Name	
Site Location	
Phone Number	
Fax Number	
Engine/Turbine Model Number	
Manufacturer	
Number of Cylinders (if applicable)	
Type of Fuel (gas, gaseous, steam, etc)	
Rating	
Application	
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	

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.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 40157A.

WOODWARD

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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.

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