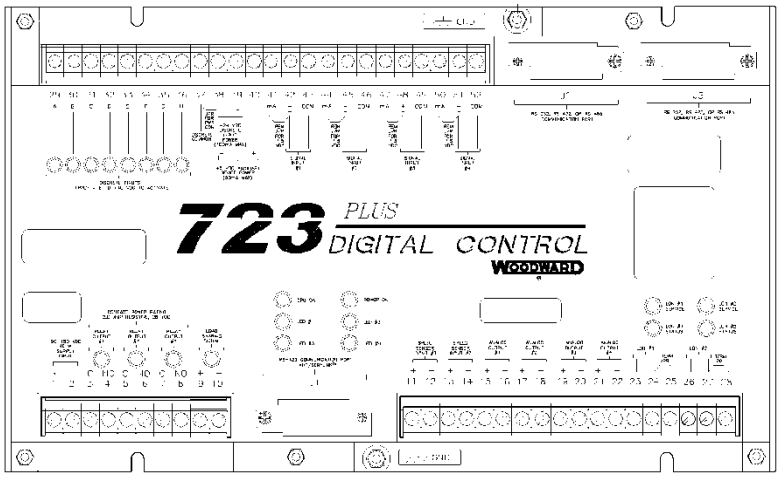
WOODWARD

Product Manual 26310
(Revision NEW)
Original Instructions



723PLUS Digital Control 8280-1056 Redundant Load Sharing

Application 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:

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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 Out-of-date translations are marked with ⚠.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.

Revisions—Changes in this publication since the last revision are indicated by a black line alongside the text.

Contents

Illustrations and Tables

Warnings and Notices

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

Introduction

This manual describes 723PLUS Digital Control, part number 8280-1056.

This control system allows up to six engines to share load on up to two busses. Each engine can be adjusted to synchronize with an existing bus and tied to that bus through a circuit breaker. Other engines can then come on line and synchronize to the same bus or a second bus. Both busses can be tied together through a tie breaker and all six engines can load share together. Each engine is told which bus it is connecting to through a “bus select” input (either a software setting or from a discrete input).

Load sharing is done over Woodward’s “Control LON”, a digital communications medium designed for use with control systems. Each 723Plus control has two LON ports and this data is repeated on each LON network making this control system redundant. Either LON network can fail and the other will continue transmitting and receiving information and keeping the load sharing system working.

⚠WARNING

Use of this equipment by untrained or unqualified personnel could result in damage to the control or the installation's equipment and possible loss of life or personal injury. Make sure personnel using or working on this equipment are properly trained.

This manual covers only equipment which is manufactured by Woodward and does not include operating instructions for the prime mover, or the driven devices or processes.

For specific operating information such as start-up, shutdown, and the prime mover's response to signals from the Woodward control, refer to the prime mover manufacturer's manual.

Before operating the unit after installation verify the following:

- Check all wiring for correct connections. See the Control Wiring Diagram in Chapter 6 and refer to hardware manual 02877 (separately supplied).
- Check the power sources for correct voltages and connections.

IMPORTANT

The Applications Program contains software that can be used to verify the signal range and provide for offset and gain adjustments (tunables). In situations where the control system's calibration is affected by the replacement of an I/O module or field device, the affected module and/or field device can be checked and calibrated by using the hand-held programmer.

Chapter 2.
Installation

The following information can be found in the 723PLUS Digital Control Hardware Manual 02877 which is supplied separately:

- Installation instructions
- General hardware description
- Hand-held programmer instructions
- Switches and indicators
- Operating instructions
- Hardware calibration instructions

For further information please refer to the Control Wiring Diagram in Chapter 6.

Chapter 3.
System Description

Part Numbers

8280-1056	723PLUS Digital Control with software
9906-619	723PLUS Digital Control, hardware only
9928-1089	GAP Diagram
9989-4075	Block Diagram
9971-1183	Plant Wiring

IMPORTANT **A value marked with an asterisk * indicates that it is a tunable value.**

Control Functions

- Speed Sensing
- Speed Reference
- Speed Control
- Generator Control
- Fuel Limiters
- Jump Rate Limiter
- Auxiliary Outputs
- Alarms
- Load Sharing via LON

Speed Sensing

The speed sensing of the engine is done by one or two speed sensors. The speed sensors can be proximity probes or magnetic pick-ups. The control is shipped with jumper settings that suit proximity probes as speed sensors.

The influence of the engine firing frequencies is attenuated by a low pass filter. After the engine is clutched the influence of engine firing frequencies is less. So a higher cutoff frequency can be adjusted. The cutoff frequency of the low pass filters is called speed filter. Speed filters can be adjusted in the service menu.

Speed Fault Indication
The speed channels are continuously checked for speed sensor failures. A failure is latched when the speed signal drops below 15 rpm or rises above 2000 rpm. The speed sensor fault detection is overridden during shutdown and stays overridden for *5 seconds after Run is selected.

For speed sensor input #1 a speed fault is indicated by means of LED#1. For speed sensor input #2 a speed fault is indicated by means of LED#2.

For speed sensor connections see the Control Wiring Diagram in Chapter 6.

Speed Reference

When started the speed reference is on idle speed, after *10 seconds it ramps to rated speed. The start fuel limiter will be in control of the actuator position. Once the speed is controlled at idle speed set point the start fuel limiter is de-activated and after *5 seconds the speed set point ramps to the rated speed set point.

Adjustment of the speed reference can be done in two ways:
- either with the raise/lower contacts
- or by the analog input signal (4–20 mA)

To activate the analog signal the value of the signal has to be in between 2 and 22 mA, and both raise/lower contacts have to be closed.

With the generator breaker switch closed, the lower and raise switches or the remote reference should only be used in the droop mode.

Speed Control

The speed control is responsible for setting the engine fuel rack position to maintain the requested engine speed. The speed control consists of the following sub functions.
- PID Controller
- LSS Bus
- Shutdown
- Actuator Output

PID Controller
The controller is a Proportional-Integral-Derivative type of controller. It compares the actual speed with the speed reference and determines the response characteristics of the actuator signal. There are two adjustable dynamic settings available and they are selected by the generator breaker switch. In Dynamics 2 a calculation is made when the fast gain window becomes active, the gain and speed error are proportional but limited between the adjusted normal and fast gain. The available dynamic settings are:
- Proportional Gain, 1 and 2
- Integrator Rate, 1 and 2
- Derivative Ratio, 1and 2
- Fast Proportional Gain, 1 and 2
- Fast Gain Window, 1 and 2

The dynamic settings of the PID must be set for the engine type and type of application. Typical settings for the PID for a medium speed engine are the following:
- Proportional gain = 0.4
- Integrator rate = 0.7
- Derivative ratio = 8.0

These settings should have enough stability to start the engine and to optimize the dynamic settings. To deal with instant load steps and/or load rejections, the window function together with the fast gain should be applied. The switching between the dynamics is done by a contact input. The generator breaker contact is used for this purpose. Once the contact input is made, the dynamics immediately switch over from dynamics to auxiliary dynamics.

LSS Bus
The low signal select bus selects between the PID or fuel limiters for control of the actuator. The signal calling for the lowest fuel is the one used for control.

Shutdown
The shutdown function, when activated by the external Run/Stop contact, sends a minimum fuel signal to the actuator final driver. In the configure menu the engine can be selected to stop in the event of a Major alarm. Engines equipped with a mechanical backup governor and operating as reverse-acting actuators should not stop in the event of a major alarm. Engines with a backup governor but forward-acting should stop in the event of a major alarm.

Actuator Output
The actuator output is a forward or reverse acting signal. To change between forward and reverse acting functions, enter the configure menu and selected the required operation.

Generator Control

Isochronous Control
After the start sequence the control can be synchronized with the raise and lower switches, the remote speed reference or the synchronizer input (if enabled in the configure menu). Once synchronized (generator breaker switch closed), the control ramps the load to the loadshare level and switches to isochronous loadsharing.

To unload, the unload switch has to be closed. The control ramps the generator load down and issues a breaker-open command at the unload trip level.

For exact load-sharing functions see 0 Load Sharing via LON.

Droop Control
After the start sequence the control can be synchronized using the raise and lower switches, the remote speed reference or the synchronizer input (if enabled in configure). Once synchronized and the droop switch and the generator breaker switch are closed, the control is in droop mode. The load of the generator can be controlled by the raise and lower switches or the remote speed reference. The control can be used in actuator or load droop. If the load sensor is configured as not used or the load sensor fails the control will be in actuator droop.

Discrete input E can be used for either Isoch/Droop or Bus Select. If the configure menu “* Configuration *”, prompt “Discrete In E is Bus Select?” is set to TRUE, discrete input E is used for selecting which bus (A or B) this engine’s generator will tie to. If “Discrete In E is Bus Select?” is set to FALSE, discrete input E is used for selecting Isochronous or Droop speed control modes.

If discrete input E is set to Bus Select, the control will go into droop mode when the circuit breaker auxiliary contact is closed. Isochronous mode will be selected when the circuit breaker auxiliary contact is open.

If discrete input E is set to Isoch/Droop, the control will use the tunable value in the “* Configuration *” menu “Bus Select (if E is Isoch/Droop)” to select which bus this unit will tie to. A = true and B = False.

Fuel Limiters
(Start Fuel Limiter & Maximum Fuel Limiter)

The start fuel limiter is activated when run is selected and is deactivated *10 seconds after the speed PID is in control. The speed PID comes in control when the speed reference is reached. The start fuel limit sets the maximum percent actuator output current at start-up. The start fuel limit is a two-slope curve which starts on a level and ramps in a time to a second level .If the engine is started and the start fuel limit is deactivated the max fuel limit becomes active.

Jump Rate Limiter

The control is equipped with a jump rate limiter which can be activated in the configure menu. The jump rate limiter limits the actuator output on sudden jumps and ramps to the required level to prevent the engine from overfueling. Above a certain load a second set of settings is available to allow a different setup on higher loads.

Auxiliary Outputs

The control has three auxiliary outputs (4–20 mA) which can be selected in the configure menu. On each output six selections can be made.

1 = PID Output
2 = Speed Output from MPU #1
3 = Speed Output from MPU #2
4 = kW Load %
5 = Limiter %
6 = Jump Rate Limit %

Auxiliary output 3 can also be used to switch a relay. This is sometimes used to reset a synchronizer on circuit breaker or tie breaker close.

Alarms

In this application the following I/O signals can cause an alarm:

- MPU # 1 Failed
- MPU # 2 Failed
- Both MPUs Failed
- Remote Speed Input Fault
- Load Sensor Fault
- Synchronizer Fault
- Overspeed
- Actuator Wire Break Detection
- LON 1 Fault
- LON 2 Fault

The three 4-20 mA inputs can be selected in the configure menu as used or not used, if selected as not used, the alarm is selected automatically as none. These inputs have three types of alarms, except the 4-20 mA inputs: no alarm, minor alarm and major alarm. In the configure menu the type of alarm can be selected:

- 1 means no alarm
- 2 means minor alarm
- 3 means major alarm

The following failures will always give a major alarm:
- Overspeed
- Both speed sensors failed

The following failure will always give a minor alarm:
- LON 1 Fault
- LON 2 Fault

Minor and major alarms are indicated by a relay and a minor and major fault LED.

Load Sharing via LON

The load sharing in this control is done via the LON network connection. Over this network data is exchanged between the controls. The following main parameters are exchanged:
- The unit's generator kW load in %
- The status of the generator circuit breaker
- The status of the bus tie breaker
- The bus selected either by software setting or discrete input E

NOTICE **Before starting the load sharing it is important that each control's LON-network address is configured.**

In the configure menu *LON COM*, the unit's network address can be tuned in the range 1-6.

Each engine must have a unique LON address or the system will not work correctly.

Taking an Engine On-line
The first engine on-line, i.e. first generator CB closed, will instantly carry the present kW load on the bus. Each following engine will be soft-loaded onto the bus. The rate at which the engine takes load can be set in service menu *KW LOAD* under "LOAD RATE (%/sec)". Default it is set at 10%/sec. This percentage is proportional to the "Maximum Load KW" set in the same service menu.

Taking an Engine Off-line
This is done through the UNLOAD contact. Once closed the UNLOAD ramp unloads the engine according to the "UNLOAD RATE (%/sec)" set in service menu *KW LOAD*. Under load level "CB OPEN UNLOAD KW", set in the same menu, a contact to open the generator CB is issued.

Bus Interconnection
Closing the bus tie breaker causes all the units to share equal load. When, upon closing of the tie breaker, a load difference exists between the buses that is larger than the preset value, the two buses are soft-loaded towards each other.

The load difference is set in service menu *KW LOAD* under "BUS LOAD DIFF (%)", the load rate is set in "BUS CONNECT RATE (%/sec)". It should be noted that these values have to be the same on all engine controls.

LON Network Failure Detection
Each units performs on both networks (LON#1 & LON#2) failure detection based on a received message timeout. Upon failure detection the unit issues a minor alarm. After 5 seconds a network auto reset is given. Both networks are running simultaneously.

When both networks detect a failure the system goes to droop mode. If the load on the engines does not change then there no or little difference is seen compared with loadsharing mode.

To return the system to loadsharing mode a reset must be given, and this can only occur when the circuit breaker is opened. The engine must first be unloaded, then the circuit breaker can be opened and a reset to the control can be made. The engine can then be synchronized. When the circuit breaker is closed the engine is immediately in loadsharing mode via the LON.

Modbus Slave Communication

The following menus list the parameters required to setup the serial connection for the Modbus® * Slave port. Refer to manual 02877 for connections.

*—Modbus is a trademark of Schneider Automation Inc.

Menu * MODBUS J3 *

Description	Range	Nominal	Final
Modbus Mode ASCII-RTU *[1] 1 = ASCII, 2 = RTU	1 to 2 *[1]	2	
Modbus ADDRES	1 to 247	1	

Menu * Modbus Com *

Description	Range	Nominal	Final
Hardware config *[2] 1 = RS232, 2 = RS422, 3 = RS485	1 to 3 *[2]	1	
Baud rate *[3] 1 = 1200 baud, 2 = 1800 baud, 3 = 2400 baud, 4 = 4800 baud, 5 = 9600 baud, 6 = 19200 baud, 7 = 38400 baud	1 to 7 *[3]	5	
Stop bits *[4] 1 = 1 stop bit, 2 = 1.5 stop bits, 3 = 2 stop bits	1 to 3 *[4]	1	
Parity *[5] 1 = Off 2 = Odd 3 = Even	1 to 3 *[5]	1	

The following addresses are assigned to the serial Modbus port.

Boolean Reads

Addr	Description
1:0001	Major Alarm
1:0002	Minor Alarm
1:0003	Speed sensor 1 failure
1:0004	Speed sensor 2 failure
1:0005	Both speed sensors failed
1:0006	Remote reference failed
1:0007	Load sensor failed
1:0008	Synchronizer failed
1:0009	Overspeed
1:0010	Actuator wire break
1:0011	LON1 failed
1:0012	LON2 failed
1:0013	Isochronous LS mode
1:0014	Droop Mode
1:0015	Unloading active
1:0016	Fuel limit active
1:0017	Tie breaker in?
1:0018	Ckt Brkr Eng 1 in?
1:0019	Ckt Brkr Eng 2 in?
1:0020	Ckt Brkr Eng 3 in?
1:0021	Ckt Brkr Eng 4 in?
1:0022	Ckt Brkr Eng 5 in?
1:0023	Ckt Brkr Eng 6 in?
1:0024	Bus Select Eng 1 in?
1:0025	Bus Select Eng 2 in?
1:0026	Bus Select Eng 3 in?
1:0027	Bus Select Eng 4 in?
1:0028	Bus Select Eng 5 in?
1:0029	Bus Select Eng 6 in?

Analog Reads

Addr	Description
3:0001	Engine Speed
3:0002	Engine load kW
3:0003	Engine load %
3:0004	LON Average Load %
3:0005	Engine 1 Load %
3:0006	Engine 2 Load %
3:0007	Engine 3 Load %
3:0008	Engine 4 Load %
3:0009	Engine 5 Load %
3:0010	Engine 6 Load %

Chapter 4.
Service and Configure Headers

General

This chapter describes the parameters that can be tuned or monitored in the GAP program. The Configure Mode Tunables section describes the values that can be configured using Configure Mode. The Service Mode Tunables section describes the values that can be adjusted using Service Mode.

For instructions on monitoring and changing tunable constants, refer to the 723PLUS Digital Control Hardware Manual 02877.

IMPORTANT **Please note that these values are provided as a guideline. The actual values should be obtained by the engine manufacturer or during commissioning.**

Configure Mode Tunables

Configurable parameters (#) in Configure Mode **cannot** be altered while the engine is running. Before entering Configure Mode you have to shutdown the engine. The following configure headers are available in order of appearance:

Menu * Configuration *

Description	Range	Nominal	Final
Gear #1 Teeth	20 to 250	#44	
Gear #2 Teeth	20 to 250	#44	
Act Forward Act	TRUE to FALSE	*TRUE	
Enable Synchronizer	TRUE to FALSE	*FALSE	
Cont Open Stop	TRUE to FALSE	*TRUE	
Overspeed	0 to 3000	720	
Use Jmp Rte Lim?	TRUE to FALSE	*FALSE	
CB Open on Stop ?	TRUE to FALSE	*FALSE	
Act mA_0	0.00 to 10.00	10.000	
Act mA_100	160.00 to 200.00	180.000	
Use Tors filter?	TRUE to FALSE	*FALSE	
Discrete In E is Bus Select?	TRUE to FALSE	*FALSE	
Bus Select (if E is Isoch/Droop)	TRUE to FALSE	*FALSE	
Speed Switch Pickup (rpm)	0 TO 2200	*500	
Speed Switch Dropout (rpm)	0 TO 2200	*400	

Menu * Set Alarms *

Description	Range	Nominal	Final
Loadsensor Used?	TRUE to FALSE	*TRUE	
Loadsensor Alarm?	2 to 3	*2	
MPU # 1 Failed Alarm?	1 to 3	*2	
MPU # 2 Failed Alarm?	1 to 3	*2	
Rem Spd Inp Alarm?	1 to 3	*1	
Spm Input Alarm?	1 to 3	1	
Stop on Major Alm?	TRUE to FALSE	*TRUE	
Brkr Open Rly NC ?	TRUE to FALSE	*FALSE	
Major Alarm Rly NC ?	TRUE to FALSE	*FALSE	
Minor Alarm Rly NC ?	TRUE to FALSE	*FALSE	
Minor Alarm/Spd Sw Rly NC ?	TRUE to FALSE	*TRUE	
Act WB Major Alm?	TRUE to FALSE	*FALSE	
LED4 as DROOP?<	TRUE to FALSE	*FALSE	
LON Alarm on Engine 1?	TRUE to FALSE	*TRUE	
LON Alarm on Engine 2?	TRUE to FALSE	*TRUE	
LON Alarm on Engine 3?	TRUE to FALSE	*TRUE	
LON Alarm on Engine 4?	TRUE to FALSE	*TRUE	
LON Alarm on Engine 5?	TRUE to FALSE	*TRUE	
LON Alarm on Engine 6?	TRUE to FALSE	*TRUE	
LON Alarm?	TRUE to FALSE	*TRUE	

To set alarms: 1 = none, 2 = minor, 3 = major.

Menu * Set Outputs *

Description	Range	Nominal	Final
Select Aux 1	1 to 6	*1	
Select Aux 2	1 to 6	*2	
Select Aux 3	1 to 6	*3	
Use Aux 3 as DO?	TRUE to FALSE	*FALSE	
DO1: False=Alarm, True=Spd Switch	TRUE to FALSE	*FALSE	

To select auxiliary outputs refer to 0 Auxiliary Outputs.

Menu * MODBUS J3 *

Refer to Modbus Slave Communication (Chapter 3) for settings.

Menu * LON COM *

Description	Range	Nominal	Final
LON 1 Address	1 to 6	1	
LON 2 Address	1 to 6	1	

Refer to 0 Load Sharing via LON for settings.

Service Mode Tunables

Tunables in Service Mode can be altered while the engine is running, provided the service headers have been enabled (where appropriate).

Menu * Alarmlog *

Description	Range	Nominal	Final
First Alarm	Monitor		
1/Spd Probe#1 Fault	Monitor		
2/Spd Probe#2 Fault	Monitor		
3/Both Probes Fault	Monitor		
4/Rem Spd Inp Flt	Monitor		
5/Load Sensor Fault	Monitor		
6/Synch Fault	Monitor		
7/Overspeed	Monitor		
8/Act wire break	Monitor		
9/LON1 Fault	Monitor		
10/LON2 Fault	Monitor		
Reset First Alarm ?	TRUE to FALSE	FALSE	
Reset Control	TRUE to FALSE	FALSE	

The alarm log is visible on the handheld when a alarm is present. If during an event more than one alarm occurs, the first alarm shows under the first alarm header, this first alarm can be cleared by tuning the reset first alarm from false to true and back to false. If no alarms are present the alarm log menu is not available.

Menu * Monitor Analog *

Description	Range	Nominal	Final
Engine Speed	Monitor		
Speed Reference	Monitor		
Spd Ref Before Bias	Monitor		
Generator Load KW	Monitor		
PID %	Monitor		
Actuator LSS (%)	Monitor		
Actuator output (%)	Monitor		
Stop Mode	Monitor		
Failsafe Mode	Monitor		
Isoch Mode	Monitor		
Droop Mode	Monitor		
Unload Mode	Monitor		
Fuel Lim Mode	Monitor		
Shutdown Mode	Monitor		

The monitor analog menu shows various parameters and the mode that the control is in.

Menu * Monitor Inputs *

Description	Range	Nominal	Final
Speed # 1 (rpm)	Monitor		
Speed # 2 (rpm)	Monitor		
Synch Inp (+/- Vdc)	Monitor		
Bs Ld Ref Inp (mA)	Monitor		
Rmt Ref Input(mA)	Monitor		
Loadsensor Inp(mA)	Monitor		
29/Run Stop	Monitor		
30/Reset	Monitor		
31/Lower	Monitor		
32/Raise	Monitor		
33/BSID	Monitor		
34/Unload	Monitor		
35/Tie Breaker	Monitor		
36/Gen Breaker	Monitor		

The monitor inputs menu shows the various inputs to the control.

Menu * Monitor Outputs *

Description	Range	Nominal	Final
Minor Alarm/Spd Sw RLY	Monitor		
Major Alarm RLY	Monitor		
CB Open RLY	Monitor		
Analog Out #1	Monitor		
Analog Out #2	Monitor		
Analog Out #3	Monitor		
AO #3 as dig.out?	Monitor		

The monitor inputs menu shows the various outputs from the control.

Menu * Monitor LON *

Description	Range	Nominal	Final
Average Load %	Monitor		
Tie Breaker in?	Monitor		
Ckt Brkr in LON 1?	Monitor		
Bus Select in Lon 1?	Monitor		
Load % LON 1	Monitor		
Ckt Brkr in LON 2?	Monitor		
Bus Select in Lon 2?	Monitor		
Load % LON 2	Monitor		
Ckt Brkr in LON 3?	Monitor		
Bus Select in Lon 3?	Monitor		
Load % LON 3	Monitor		
Ckt Brkr in LON 4?	Monitor		
Bus Select in Lon 4?	Monitor		
Load % LON 4	Monitor		
Ckt Brkr in LON 5?	Monitor		
Bus Select in Lon 5?	Monitor		
Load % LON 5	Monitor		
Ckt Brkr in LON 6?	Monitor		
Bus Select in Lon 6?	Monitor		
Load % LON 6	Monitor		

The monitor LON menu shows the status of LON communications for controls 1 to 6.

Menu * Speed Setting *

Description	Range	Nominal	Final
Idle Speed	0.00 to 2000.00	360.000	
Rated Speed	0.00 to 2000.00	600.000	
Raise Speed Limit	0.00 to 2000.00	630.000	
Wait Min Spd Time	1.00 to 60.00	5.000	
Accel Rate rpm/sec	0.10 to 100.00	10.000	
Synchronizer Rate	0.10 to 100.00	1.000	
Speed Raise Rate	0.00 to 100.00	1.000	
Speed Lower Rate	0.00 to 100.00	1.000	
4mA Remote Ref	0.00 to 1000.00	360.000	
20mA Remote Ref	0.00 to 2000.00	630.000	
Spd Flt Ovrd Time	0.00 to 60.00	5.000	
Spd Fil MPU#1 Hz	0.01 to 30.00	3.000	
Spd Fil MPU#2 Hz	0.01 to 30.00	3.000	

The speed setting menu is used to set the speed reference parameters.

- Wait at minimum speed is the time the reference stays at idle speed before it ramps to rated.
- Acceleration rate is the rate used to ramp from idle to rated.
- Synchronizer rate is active on rated speed when the generator breaker switch is open.
- Speed raise and lower rate are used to ramp the speed reference up and down if the raise and lower switches or the remote reference is used.
- 4 mA and 20 mA remote reference are the references at 4 mA and 20 mA.
- The speed fault override time is the time the speed fault override is active after the run switch is made.

Menu * KW Load *

Description	Range	Nominal	Final
Maximum Load KW	0.00 to 25000.00	3800.000	
CB OPEN UNLOAD kW	0.00 to 1000.00	50.000	
Load Sens at 4 mA	-10.00 to 25000.00	0.000	
Load Sens at 20 mA	0.00 to 25000.00	5000.000	
Load Input Filter	0.01 to 10.00	0.200	
LOAD RATE (%/sec)	0.00 to 100.00	10.00	
UNLOAD RATE (%/sec)	0.00 to 100.00	10.00	
BUS CONNECT RATE (%/sec)	0.01 to 100.00	10.00	
BUS LOAD DIFF (%)	0.00 to 100.00	10.00	

The KW Load menu is used to set the KW reference parameters.

More details about parameters can be found in 0 Load Sharing via LON.

Menu * Droop *

Description	Range	Nominal	Final
No Load Act %	0 to 100	*25	
Full Load Act %	0 to 100	*80	
Droop %	0 to 10	*5	

The droop menu is used to set the droop parameters. The no load actuator and full load actuator set point must be set according to the real position of the actuator at no and full load.

Menu * Fuel Limits *

Description	Range	Nominal	Final
Start Lmt Dis Time	0 to 60	*3	
Maximum Limit	0 to 101	*101	
Strt Lmt P1 %/LSS	0 to 101	*44	
Strt Lmt P2 %/LSS	0 to 101	*44	
Strtlmt Rte units/s	0.1 to 100	*2.5	

The fuel limits menu can be used to set the fuel limit parameters.

The start limit disable time is the time after which the start limit is disabled when the PID is in control. Maximum limit is active when fuel limit is disabled. Start limit P1 is the level at which the startfuel limit starts and ramps to the startfuel limit P2 set point in the time as set by the limit rate.

Menu * Dynamics 1 *

Description	Range	Nominal	Final
Gain 1	0.01 to 100	*0.35	
Integrator Rate 1	0.01 to 100	*0.6	
Derivative Ratio 1	0.01 to 100	*20	
Fast Gain 1	0.01 to 100	*0.6	
Fast Gain Window 1	2 to 1000	*5	

The dynamics 1 menu is used to set the dynamics 1 parameters.

Menu * Dynamics 2 *

Description	Range	Nominal	Final
Gain 2	0.01 to 100.00	0.300	
Integrator Rate 2	0.01 to 100.00	0.700	
Derivative Ratio 2	0.01 to 100.00	40.000	
Fast Gain 2	0.01 to 100.00	1.000	
Fast Gain Window 2	2.00 to 1000.00	5.000	

The dynamics 2 menu is used to set the dynamics 2 parameters.

Menu * Tune Aux Output *

Description	Range	Nominal	Final
1/PID %at 4mA	-100.00 to 100.00	0.000	
1/PID% at 20mA	0.00 to 200.00	100.000	
2/MPU#1rpm at 4 mA	0.00 to 1000.00	0.000	
2/MPU#1rpm at 20 mA	0.00 to 4000.00	1000.000	
3/MPU#2rpm at 4 mA	0.00 to 1000.00	0.000	
3/MPU#2rpm at 20 mA	0.00 to 4000.00	1000.000	
4/Load %at 4mA	-100.00 to 100.00	0.000	
4/Load% at 20mA	0.00 to 200.00	100.000	
5/Act% at 4 mA	-100.00 to 100.00	0.000	
5/Act% at 20 mA	0.00 to 200.00	100.000	
7/Jmp Lim% at 4mA	-100.00 to 100.00	0.000	
7/Jmp Lim% at 20mA	0.00 to 200.00	100.000	

The tune auxiliary output menu is used to tune the selected auxiliary outputs.

Menu * Jump Rate Limit *

This menu shows when selected in Configure Mode.

Description	Range	Nominal	Final
Jump 1 %/Act	0 to 100	*35	
Rate Jump 1 %/sec	0 to 10	*0.5	
Enbl Jmp2 at % Load	0 to 100	*60	
Jump 2 %/Act	0 to 110	*40	
Rate Jump 2 %/sec	0 to 10	*2	

The jump rate limiter menu is used to tune the jump rate limiter. Jump 1 is the allowed jump from the PID before the rate limiter becomes active. Rate Jump 1 is the rate at which the limiter ramps up. Enable jump 2 is the load in % at which the second limiter becomes active. Jump 2 and rate 2 have the same function as 1.

Menu * Calibration *

Description	Range	Nominal	Final
Bs Ld Ref Inp Offs	-100.00 to 100.00	0.000	
Bs Ld Ref Inp Gain	0.01 to 10.00	1.000	
Rmt Ref Input Offs	-100.00 to 100.00	0.000	
Rmt Ref Input Gain	0.01 to 10.00	1.000	
Loadsensr Inp Offs	-100.00 to 100.00	0.000	
Loadsensr Inp Gain	0.01 to 10.00	1.000	
Offset AUX #1	-100.00 to 100.00	0.000	
Gain AUX #1	0.10 to 10.00	1.000	
Offset AUX #2	-100.00 to 100.00	0.000	
Gain AUX #2	0.10 to 10.00	1.000	
Offset Aux #3	-100.00 to 100.00	0.000	
Gain Aux #3	0.10 to 10.00	1.000	

The analog input and output signals can be calibrated in this menu.

Menu * CB Open Pulse *

Description	Range	Nominal	Final
Pulse Used ?	TRUE to FALSE	FALSE	
Active above KW (%)	0.00 to 101.00	60.000	
Active above ACT (%)	0.00 to 101.00	60.000	
Pulse Time (sec)	0.00 to 10.00	0.200	
Deactivate Delay (sec)	0.00 to 5.00	0.200	

This menu determines if circuit breaker open pulse is used and how it must act.

Menu * Modbus Com *
See Modbus Slave Communication (Chapter 3) for more details.

Menu * Port Setting *

Description	Range	Nominal	Final
Set Download Mode	1 to 2	2	

In this menu the configuration of the 723PLUS J1 port can be changed. The settings are:
1 = ServLink
2 = HandHeld
The default is 2 which allows a Woodward Handheld Programmer (part number 9907-205) to be connected to J1 and used to change or view parameters.

Changing to setting 1 activate the ServLink mode. After 10 seconds the Handheld Programmer is disabled. A PC can be connected to J1 and a ServLink network can be built over which Watch Window can be used or new software can be uploaded.

Chapter 5.
Hand Held Programmer

Hand-Held Programmer and Menus

The Hand-held Programmer is a hand-held computer terminal that gets its power from the 723PLUS Digital Control. The terminal connects to the RS-422 communication serial port on the control.

The programmer does a power-up self-test whenever it is plugged into the control. When the self-test is complete, the screen displays two lines of information. This is information relating to the application. Pressing the 'ID' key changes the display to show the Woodward logo with the country name ("Woodward (NL)") and application name of the system. Press "ID" again for the software part number.

The programmer screen is a four-line, back lighted LCD display. The display lets you look at two separate functions or menu items at the same time. Use the ▲▼ "Up/Down Arrow" key to toggle between the two displayed items (an "@" indicates the item in the active menu). Use the BKSP and SPACE keys to scroll through the display to show the remainder of a prompt if it is longer than the display screen's 18 characters.

The 723PLUS Digital Control has three sets of menus: the Service menus, the Configure menus and the Debug menus. The Service menus allow easy access and tuning while the engine is running. The Configure menus may only be entered if the I/O is shutdown, and hence the engine stopped. The Debug menu allows access to the GAP software.

Configure Menus

To access the Configure menus, the engine must be shutdown. Press the **.** key. The display will show, 'To Enable CONFIGURE Press *ENTER*'. Press the **ENTER** key and the display will show, 'To Shutdown I/O, Press *ENTER*'. Press the **ENTER** key and this will allow you to get into the Configure menus.

IMPORTANT **If the engine is running during this process, it will be shutdown due to the shutting down of the I/O of the control.**

To move between the menus use the ▲ and ▼ keys. To move through the set points within a menu use the ◀ and ▶ keys,. Once in a menu, press the **ESC** key to return to the menu header.

To leave the Configure menus press the **ESC** key. The message 'ReBooting Control' will appear. The set points are automatically saved when leaving Configure.

Service Menus

To access the Service menus press the ▼ key. To move between menus, and to move through set points within menus, follow the instructions as for the Configure menus. Also to return to the menu header, or to leave Service, follow the Configure instructions.

Debug Menus

To access the Debug first press ■ (solid square) after which the ▼ key should be pressed. To move between category menus use the ◀ and ▶ keys, once in the right category move through the GAP blocks by using the ▲ and ▼ keys.

Within a GAP block every output and tunable (*) input can been seen by using the ◀ and ▶ keys.

A Tunable (*) can be changed by using the "Turtle Up" or the "Rabbit Up" keys to increase the value, and the "Turtle Down" or "Rabbit Down" keys to decrease the value (see also adjusting set points).

To return to the menu header press the ▼ key, or to leave Service, follow the Configure instructions.

Adjusting Set Points

To adjust a set point, use the "turtle up" or the "rabbit up" keys to increase the value, and the "turtle down" or "rabbit down" keys to decrease the value. The "rabbit up" and "rabbit down" keys will make the rate of change faster than the "turtle up" and "turtle down" keys. This is useful during initial set-up where a value may need to be changed significantly. Where necessary, to select TRUE, use either the "turtle up" or the "rabbit up" keys, and to select FALSE, use the "turtle down" or "rabbit down" keys.

To obtain an exact value, press the "=" key. Key in the required figure and press **ENTER**.

IMPORTANT

This may only be done if the figure is within 10% of the existing value.

To save set points at any time, use the **SAVE** key. This transfers all new set point values into EEPROM memory. The EEPROM retains all set points when power is removed from the control.

NOTICE

To prevent possible damage to the engine resulting from improper control settings, make sure you save the set points before removing power from the control. Failure to save the set points before removing power from the control causes them to revert to the previously saved settings.

Hand-Held Programmer Keys

The programmer keys have the following functions (see Figure 5-1):

◀ (left arrow)	Moves backward through Configure or Service, one menu at a time.
▶ (right arrow)	Moves forward through Configure or Service, one menu at a time.
▲▼ (up/down arrow)	Toggles between the two displayed items (the first letter of the active menu item will blink).
▲ (up arrow)	Moves backward through each menu, one step at a time.
▼ (down arrow)	Advances through each menu, one step at a time. Selects Service from Main Screen.
 (turtle up)	Increases the displayed set point value slowly.
 (turtle down)	Decreases the displayed set point value slowly.
 (rabbit up)	Increases the displayed set point value quickly (about 10 times faster than the turtle keys).
 (rabbit down)	Decreases the displayed set point value quickly (about 10 times faster than the turtle keys).
— (minus)	Increases set point values by one step at a time.
+ (plus)	Decreases set point values by one step at a time.
■ (solid square)	Debug mode.
ID	Displays the Woodward logo, application name and software revision.
ESC	To return to menu header or to main screen.
SAVE	Saves entered values (set points).
BKSP	Deletes last figure when entering exact values.
SPACE	Not used.
ENTER	Used when entering exact values and accessing Configure.
= (equals)	To enter exact values (within 10%).
. (decimal)	To select Configure.

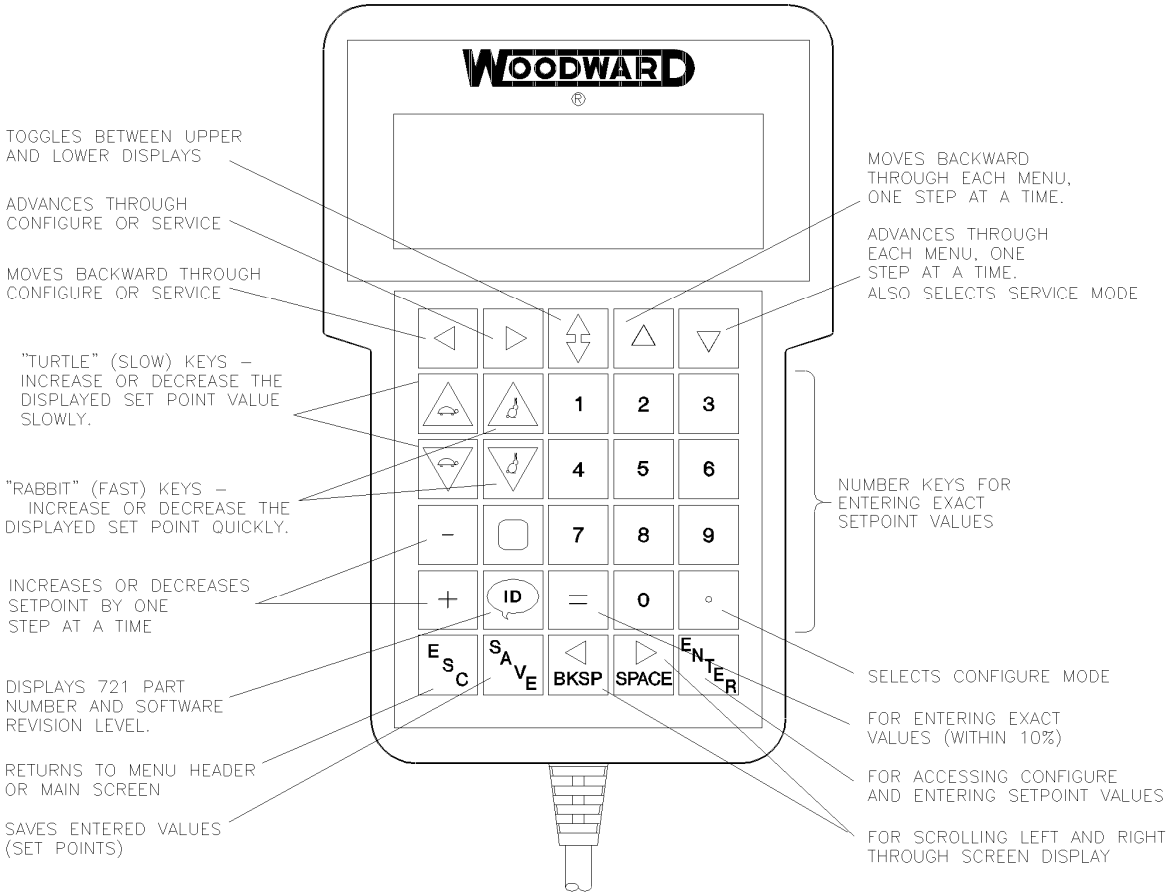
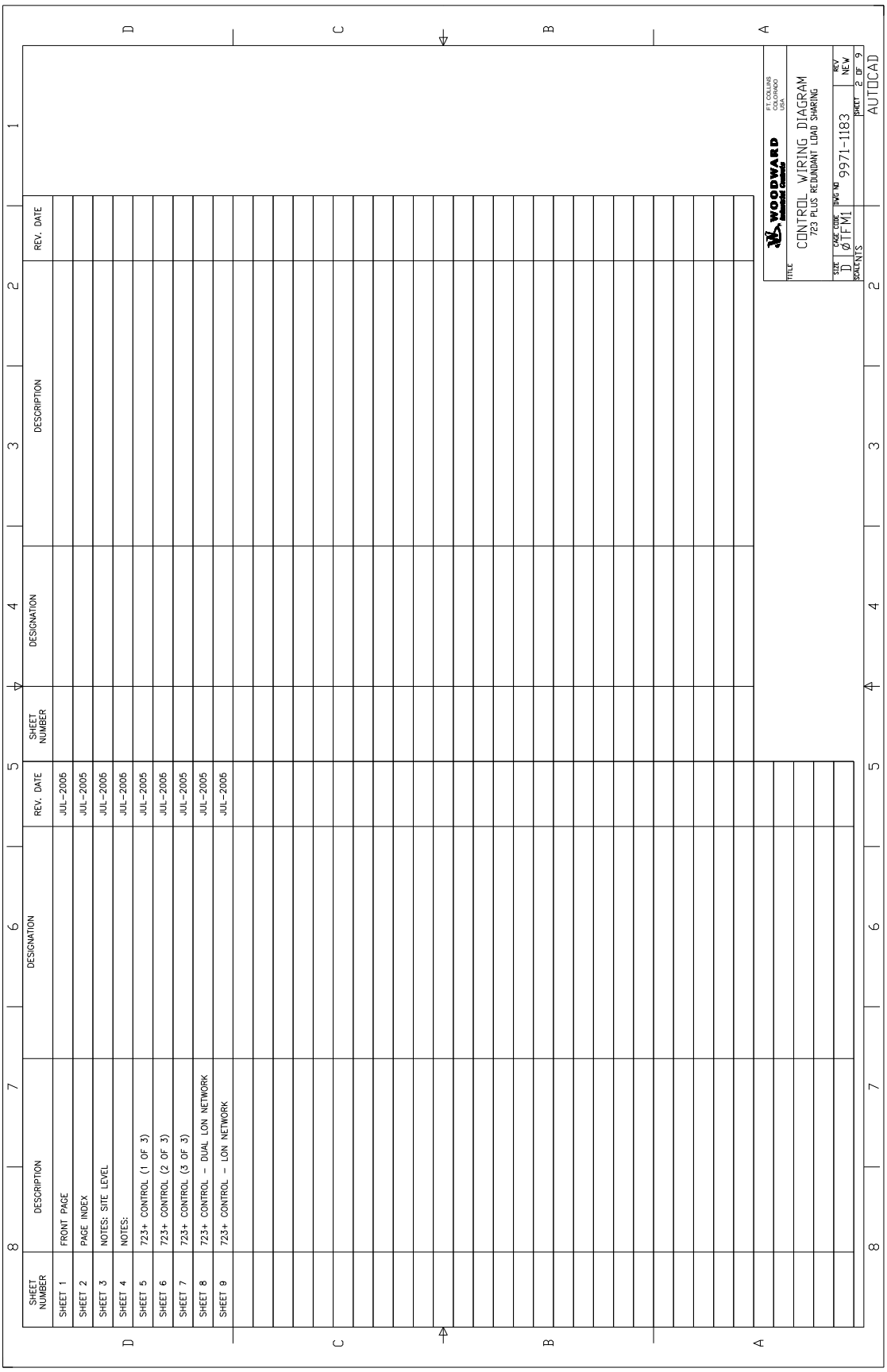


Figure 5-1. Hand-held Programmer

Chapter 6.
Control Wiring Diagram

This chapter contains Control Wiring Diagram 9971-1183 (9 pages).


Control Wiring Diagram
723 CONTROL
REDUNDANT LOAD SHARING
REVISION HISTORY
REV
DESCRIPTION
DATE
APPROVED
NEW
E/C 1081323
DPENNI AUG-2006
JWILD
THIS DRAWING OR ANY REPRODUCTION OF IT SHALL NOT BE USED FOR MANUFACTURE, PRODUCTION OR PROCUREMENT WITHOUT THE EXPRESS WRITTEN PERMISSION OF THE WOODWARD GOVERNOR COMPANY OR ONE OF ITS SUBSIDIARIES. USE OR REPRODUCTION FOR USE AS A WORK MANUFACTURED OR PRODUCED BY WOODWARD GOVERNOR COMPANY OR ONE OF ITS SUBSIDIARIES IS PROHIBITED.
MATERIALS
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.
THIRD ANGLE PROJECTION
APPROVED JWILD JUL-2005
CHECKED DPENNI JUL-2005
DRAWN DPENNI JUL-2005
WOODWARD
FT. COLLINS COLORADO USA
TITLE
CONTROL WIRING DIAGRAM
723 PLUS REDUNDANT LOAD SHARING
SIZE D
CAGE CODE 0TFM1
DWG NO 9971-1183
REV NEW
SCALE NTS
SHEET 1 OF 9
AUTOCAD



SHEET NUMBER	DESCRIPTION	DESIGNATION	REV. DATE
SHEET 1	FRONT PAGE		JUL-2006
SHEET 2	PAGE INDEX		JUL-2005
SHEET 3	NOTES: SITE LEVEL		JUL-2006
SHEET 4	NOTES:		JUL-2006
SHEET 5	723+ CONTROL (1 OF 3)		JUL-2005
SHEET 6	723+ CONTROL (2 OF 3)		JUL-2006
SHEET 7	723+ CONTROL (3 OF 3)		JUL-2005
SHEET 8	723+ CONTROL - DUAL LON NETWORK		JUL-2005
SHEET 9	723+ CONTROL - LON NETWORK		JUL-2006

SHEET NUMBER	DESIGNATION	DESCRIPTION	REV. DATE

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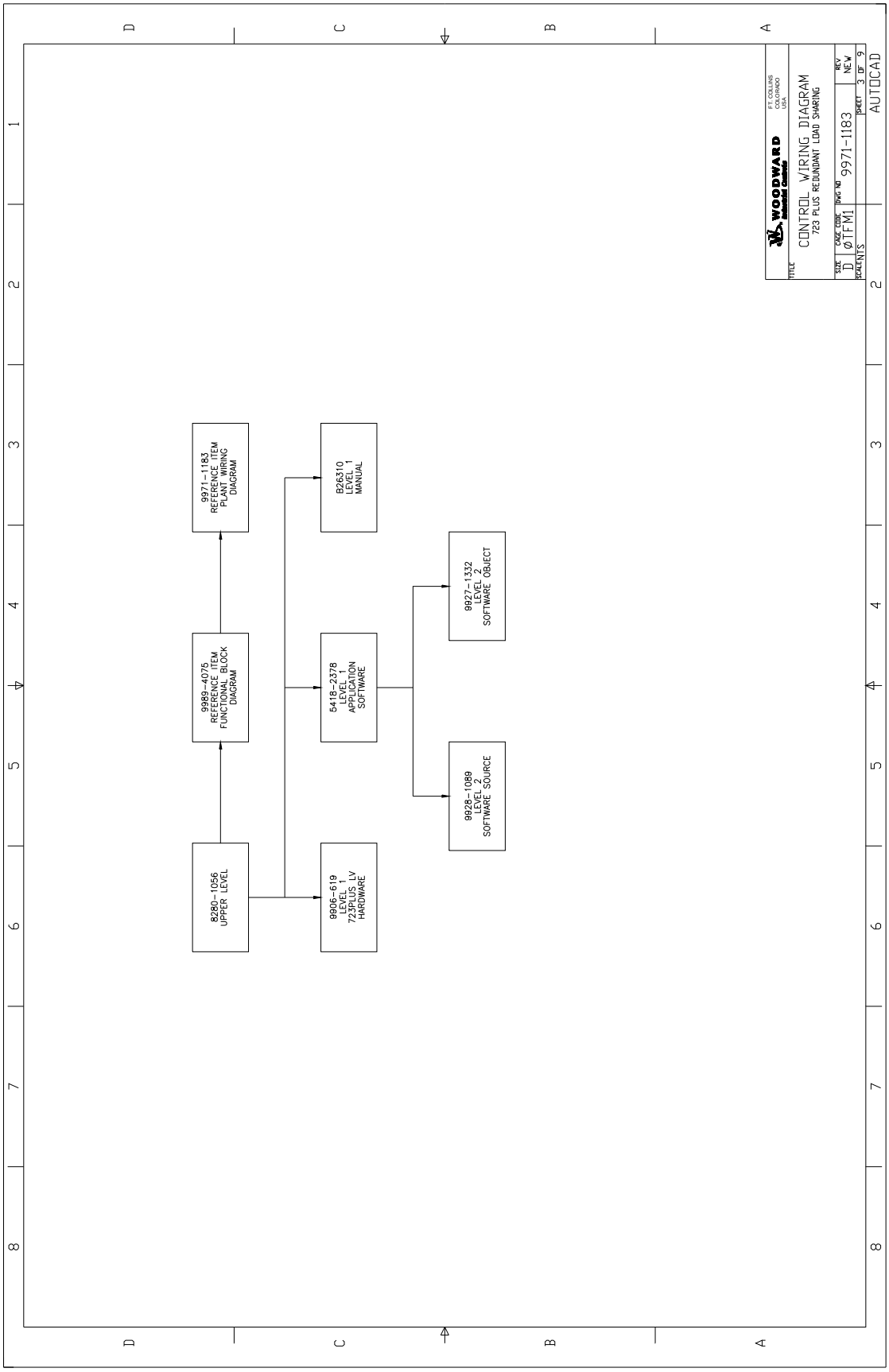
TITLE: CONTROL WIRING DIAGRAM
723 PLUS REDUNDANT LOAD SHARING

SIZE D | CAGE CODE 0TFM1 | DWG NO 9971-1183 | REV NEW

SCALE NTS | SHEET 2 OF 9

AUTOCAD


WOODWARD
FT. COLLINS
COLORADO
USA
TITLE
CONTROL WIRING DIAGRAM
723 PLUS REDUNDANT LOAD SHARING
SIZE
D
CAGE CODE
ØTFM1
DWG NO
9971-1183
REV
NEW
SCALE NTS
SHEET 3 OF 9
AUTOCAD
8280-1056
UPPER LEVEL
9989-4075
REFERENCE ITEM
FUNCTIONAL BLOCK
DIAGRAM
9971-1183
REFERENCE ITEM
PLANT WIRING
DIAGRAM
9906-619
LEVEL 1
723PLUS LV
HARDWARE
5418-2378
LEVEL 1
APPLICATION
SOFTWARE
B26310
LEVEL 1
MANUAL
9928-1089
LEVEL 2
SOFTWARE SOURCE
9927-1332
LEVEL 2
SOFTWARE OBJECT

NOTES:

1. SHIELDED WIRES ARE TWISTED PAIRS, WITH SHIELD GROUNDED AT CONTROL END ONLY, WHEN MOUNTING CONTROL TO BULKHEAD, USE THE GROUNDING STUD AND HARDWARE SUPPLIED WITH THE CHASSIS TO ENSURE PROPER GROUNDING.
2. SHIELD MUST NOT BE GROUNDED AT ANY EXTERNAL POINT UNLESS OTHER WISE NOTED.
3. ALL SHIELDS MUST BE CARRIED CONTINUOUSLY THROUGH ALL TERMINAL BLOCKS AND MUST NOT BE TIED TO OTHER SHIELDS EXCEPT AT THE COMMON GROUND POINT. THE SHIELDS ARE TIED TOGETHER AT THE GROUND STUD.

4. REMOVE JUMPER FOR VOLTAGE INPUT.
5. REMOVE JUMPER BETWEEN 37 & 38 IF USING EXTERNAL DISCRETE INPUT POWER. FOR EXTERNAL DISCRETE INPUT POWER, USE TERMINAL 37 FOR (-) AND (+) TO APPROPRIATE SWITCH.
6. DISCRETE INPUTS ARE ISOLATED FROM OTHER CIRCUITS AND INTENDED TO BE POWERED BY TB1-39 (+24VDC) LEAVING THE JUMPER IN PLACE. INPUT CURRENT IS NORMALLY 10mA PER INPUT INTO 2210 OHM.
7. UNLESS OTHERWISE SPECIFIED:
   A. RELAYS SHOWN DE-ENERGIZED
   B. RELAYS ENERGIZED FOR FUNCTION
   C. RELAY CONTACT RATING FOR MINIMUM 100,000 OPERATIONS
      RESISTIVE - 2.0 AMPERES AT 28VDC
                  0.10 AMPERES AT 115VAC, 50 TO 400Hz
      INDUCTIVE - 0.75 AMPERES AT 28VDC, 0.2 HENRY
                  0.10 AMPERES AT 28VDC, LAMP
8. ANALOG OUTPUT SIGNALS TO OTHER SYSTEMS MUST BE ISOLATED FROM GROUND EITHER BY DESIGN OR EMPLOYMENT OF ISOLATION AMPLIFIERS.
9. ANALOG INPUT SIGNALS FROM OTHER SYSTEMS MUST BE ISOLATED FROM GROUND EITHER BY DESIGN OR EMPLOYMENT OF ISOLATION AMPLIFIERS.
10. FACTORY SET FOR MPU INPUT.
11. DISCRETE INPUTS RESETS SPEED REFERENCE BACK TO RATED SPEED UPON OPENING OF CONTACT. CONTACT CAN BE JUMPERED WITH INPUT 'H' (TB1-36) FOR OPERATION PARALLEL TO GENERATOR BREAKER CONTACT.
12. INTERNAL POWER SUPPLY PROVIDES DC ISOLATION BETWEEN THE POWER SOURCE AND ALL OTHER INPUTS AND OUTPUTS.
13. COMMUNICATION PORT J1 CAN ONLY BE USED WITH THE WOODWARD ST2000 HANDHELD PROGRAMMER (P/N 9907-205)
14. COMMUNICATION PORT J2 OR J3 CAN BE CONFIGURED AS A RS-232, RS-422 OR RS-485 SERIAL INTERFACE. PORT CONFIGURATION CAN BE DONE IN THE APPLICATION SOFTWARE ONLY. FOR THE PIN ASSIGNMENT OF J2 AND J3 SEE HARDWARE MANUAL 02758.
15. FUNCTIONING OF RUN/STOP CONTACT CAN BE ALTERED BETWEEN - OPEN FOR STOP, OPEN FOR RUN.

16. USE TWISTED PAIR SHIELDED WIRES ONLY.
17. PROVIDE JUMPER FROM TERMINAL 9 TO 22 TO MAKE ACTUATOR WIRE BREAK DETECTION POSSIBLE.
18. REFER TO MANUAL 02877 FOR WIRING INSTURCTIONS OF LON NETWORK.
19. UP TO SIX ENGINES CAN BE USED IN THIS APPLICATION. IF LESS THAN SIX ARE USED BE SURE TO TERMINATE BOTH LON NETWORKS AT THE END UNITS.

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TITLE: CONTROL WIRING DIAGRAM
723 PLUS REDUNDANT LOAD SHARING

SIZE: D | CAGE CODE: 07FM1 | DWG NO: 9971-1183 | REV: NEW

SCALE: NTS | SHEET 4 OF 9

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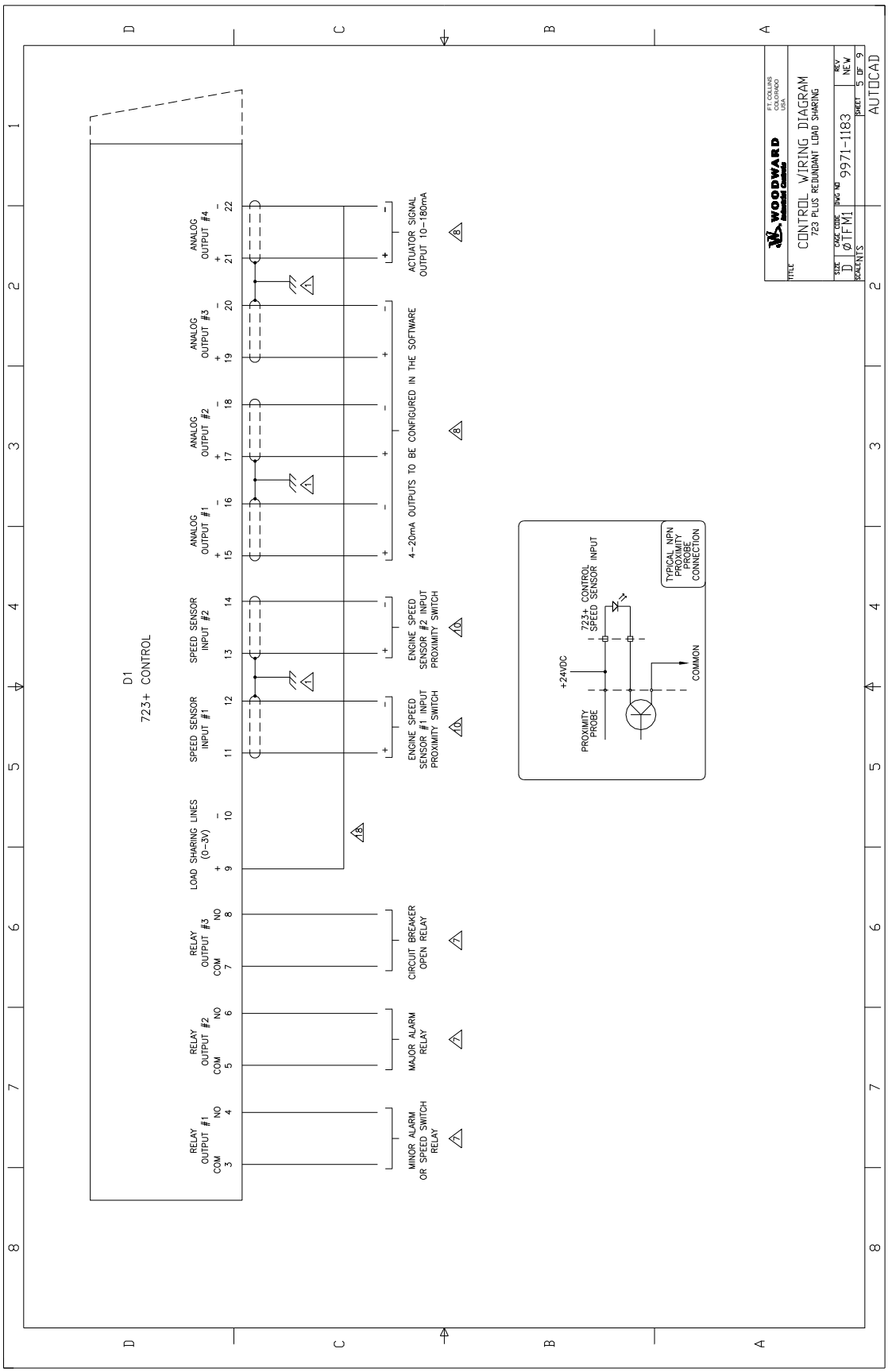
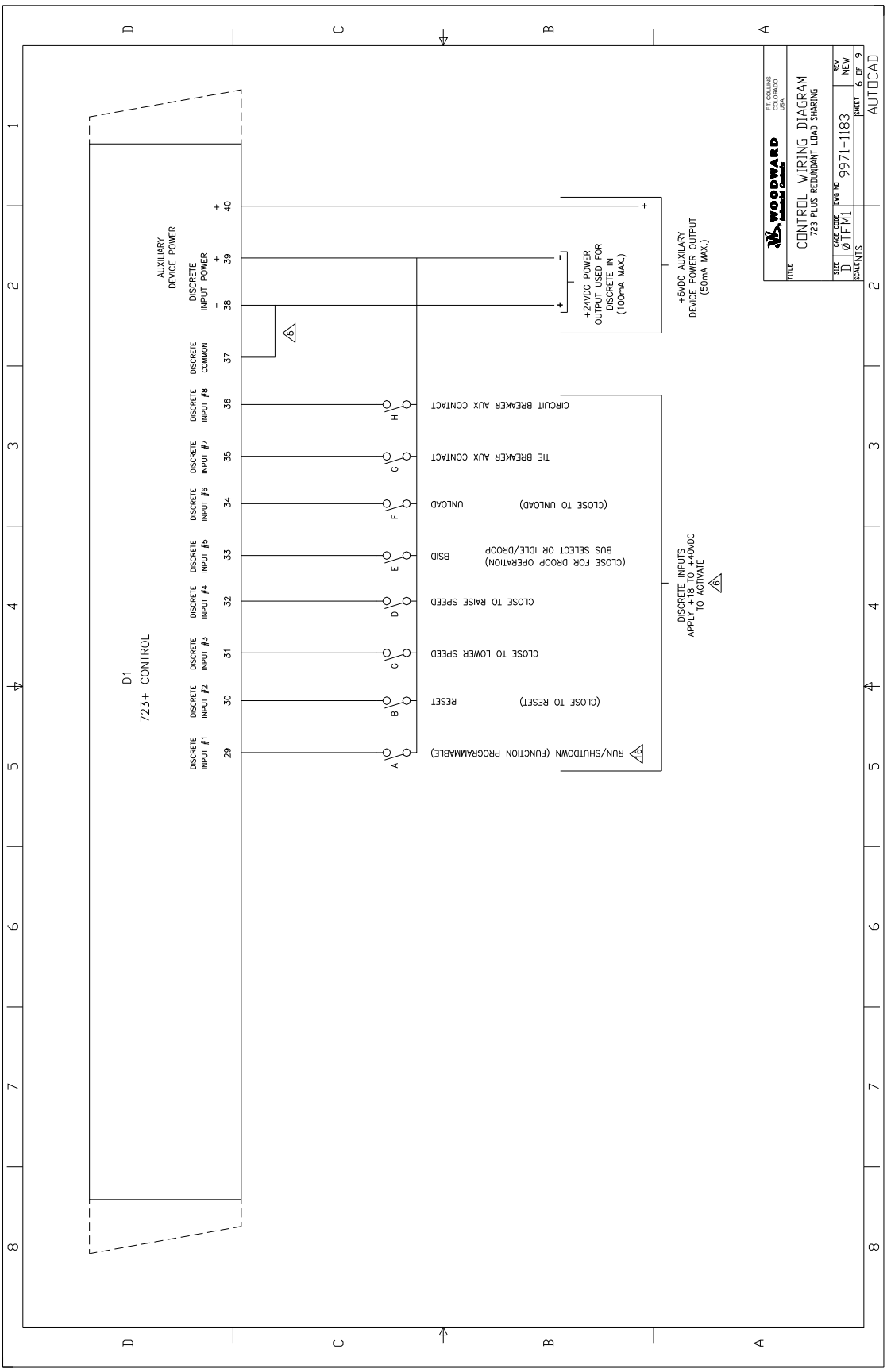

D1
723+ CONTROL
RELAY OUTPUT #1 COM 3 NO 4
RELAY OUTPUT #2 COM 5 NO 6
RELAY OUTPUT #3 COM 7 NO 8
LOAD SHARING LINES (0-5V) + 9 - 10
SPEED SENSOR INPUT #1 11 12
SPEED SENSOR INPUT #2 13 14
ANALOG OUTPUT #1 + 15 - 16
ANALOG OUTPUT #2 + 17 - 18
ANALOG OUTPUT #3 + 19 - 20
ANALOG OUTPUT #4 + 21 - 22
MINOR ALARM OR SPEED SWITCH RELAY
MAJOR ALARM RELAY
CIRCUIT BREAKER OPEN RELAY
ENGINE SPEED SENSOR #1 INPUT PROXIMITY SWITCH
ENGINE SPEED SENSOR #2 INPUT PROXIMITY SWITCH
4-20mA OUTPUTS TO BE CONFIGURED IN THE SOFTWARE
ACTUATOR SIGNAL OUTPUT 10-180mA
PROXIMITY PROBE
+24VDC
723+ CONTROL SPEED SENSOR INPUT
COMMON
TYPICAL NPN PROXIMITY PROBE CONNECTION
WOODWARD
FT. COLLINS COLORADO USA
TITLE
CONTROL WIRING DIAGRAM
723 PLUS REDUNDANT LOAD SHARING
SIZE D
CAGE CODE 07TFM1
DWG NO 9971-1183
REV NEW
SCALE NTS
SHEET 5 OF 9
AUTOCAD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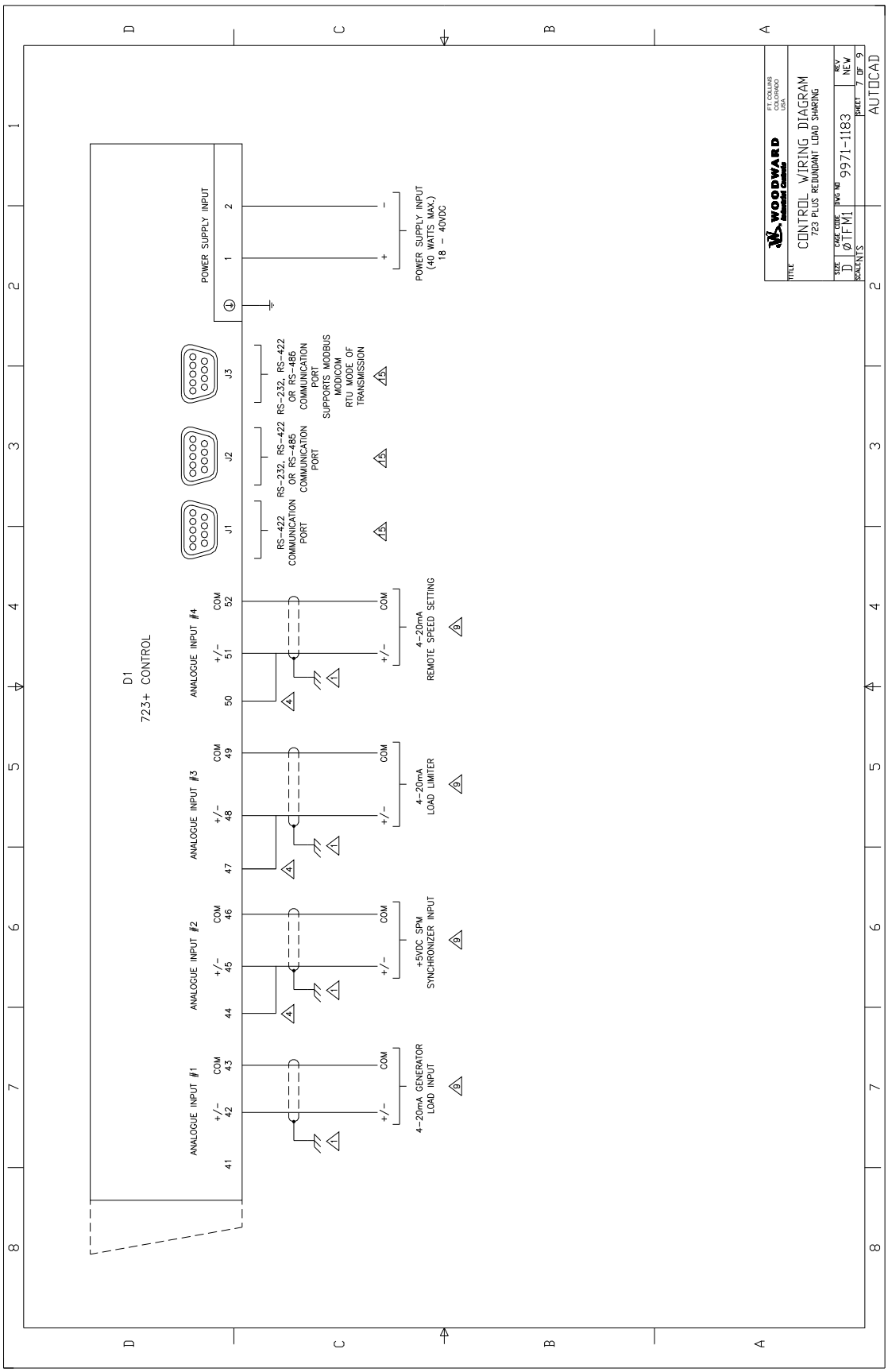
FT. COLLINS COLORADO USA
CONTROL WIRING DIAGRAM
723 PLUS REDUNDANT LOAD SHARING
SIZE D
CAGE CODE 0TFM1
DWG NO 9971-1183
REV NEW
SCALE NTS
SHEET 6 OF 9
AUTOCAD
D1
723+ CONTROL
AUXILIARY DEVICE POWER
DISCRETE INPUT POWER + 39
DISCRETE COMMON 37
DISCRETE INPUT #8 36
DISCRETE INPUT #7 35
DISCRETE INPUT #6 34
DISCRETE INPUT #5 33
DISCRETE INPUT #4 32
DISCRETE INPUT #3 31
DISCRETE INPUT #2 30
DISCRETE INPUT #1 29
+ 40
+ 38
+24VDC POWER OUTPUT USED FOR DISCRETE IN (100mA MAX.)
+6VDC AUXILIARY DEVICE POWER OUTPUT (50mA MAX.)
CIRCUIT BREAKER AUX CONTACT
TIE BREAKER AUX CONTACT
UNLOAD (CLOSE TO UNLOAD)
BSID (CLOSE FOR DROOP OPERATION) BUS SELECT OR IDLE/DROOP
CLOSE TO RAISE SPEED
CLOSE TO LOWER SPEED
RESET (CLOSE TO RESET)
RUN/SHUTDOWN (FUNCTION PROGRAMMABLE)
DISCRETE INPUTS APPLY +18 TO +40VDC TO ACTIVATE
A
B
C
D
E
F
G
H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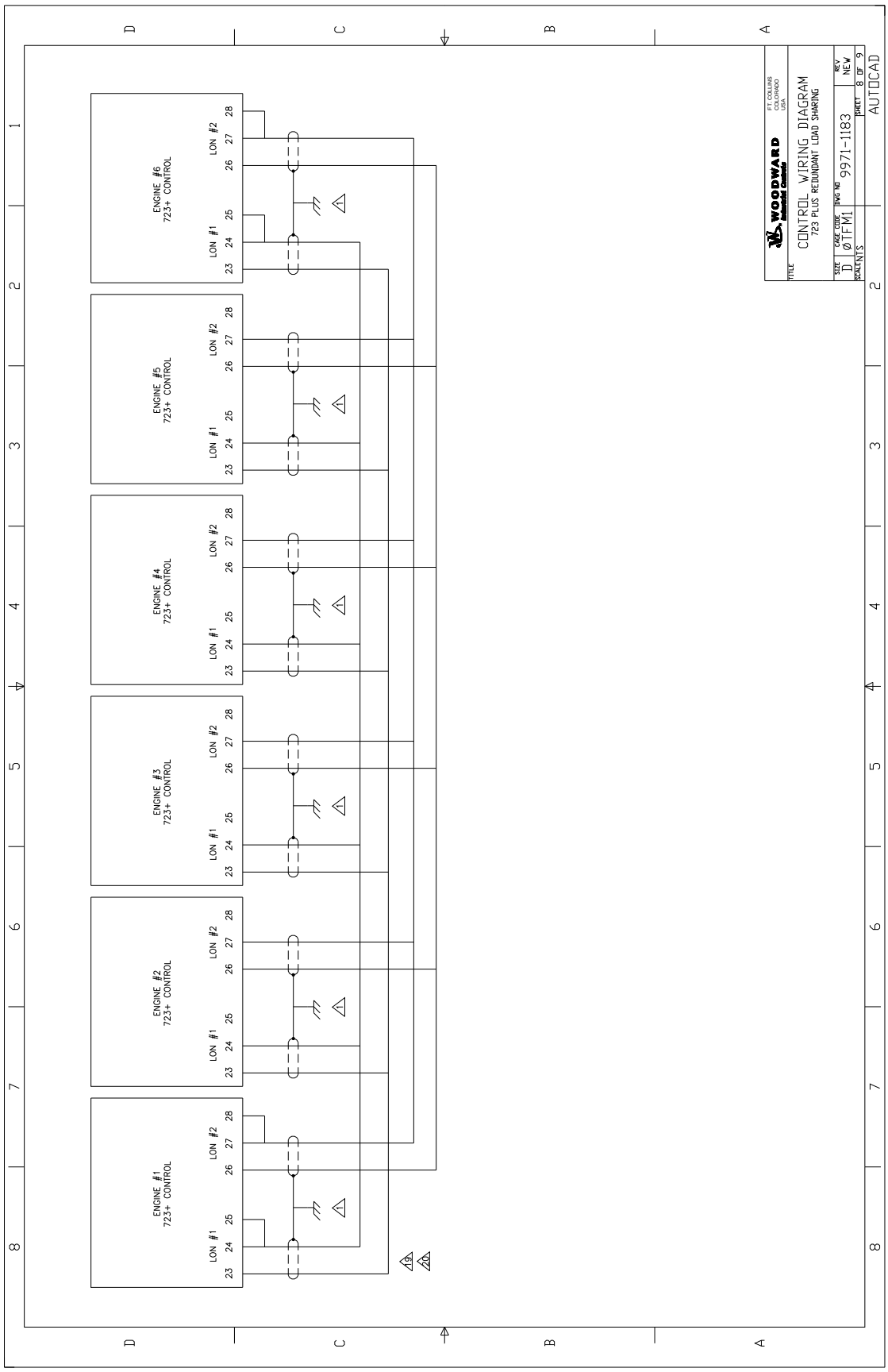
COLORADO
USA
CONTROL WIRING DIAGRAM
723 PLUS REDUNDANT LOAD SHARING
SIZE D
CAGE CODE 07TFM1
DWG NO 9971-1183
REV NEW
SCALE NTS
SHEET 7 OF 9
AUTOCAD
D1
723+ CONTROL
POWER SUPPLY INPUT
1
2
POWER SUPPLY INPUT
(40 WATTS MAX.)
18 – 40VDC
J1
J2
J3
RS-422 COMMUNICATION PORT
RS-232, RS-422 OR RS-485 COMMUNICATION PORT
RS-232, RS-422 OR RS-485 COMMUNICATION PORT
SUPPORTS MODBUS MODICOM RTU MODE OF TRANSMISSION
ANALOGUE INPUT #1
41
42
43
4-20mA GENERATOR LOAD INPUT
ANALOGUE INPUT #2
44
45
46
+5VDC SPM SYNCHRONIZER INPUT
ANALOGUE INPUT #3
47
48
49
4-20mA LOAD LIMITER
ANALOGUE INPUT #4
50
51
52
4-20mA REMOTE SPEED SETTING
+/-
COM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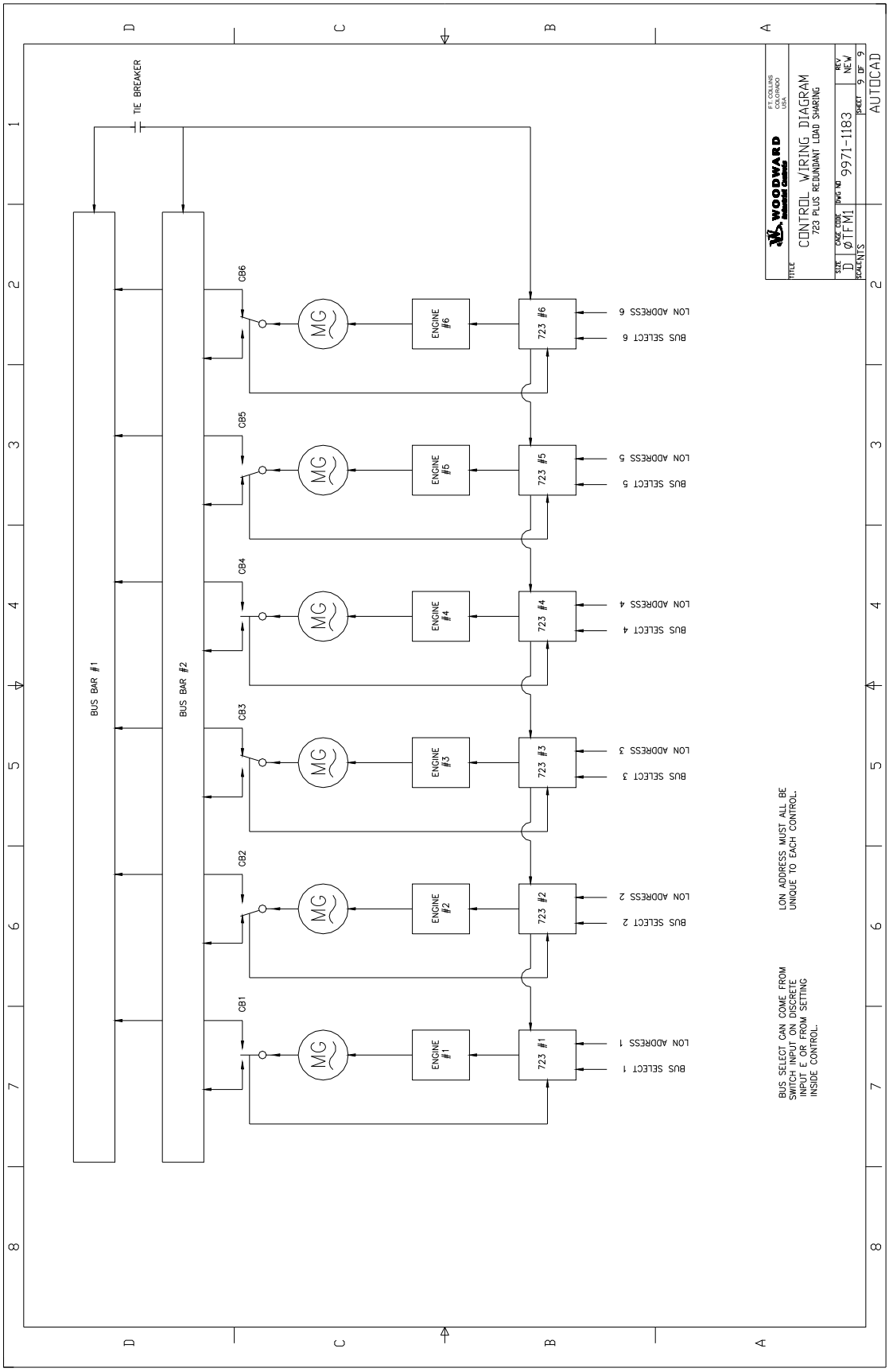
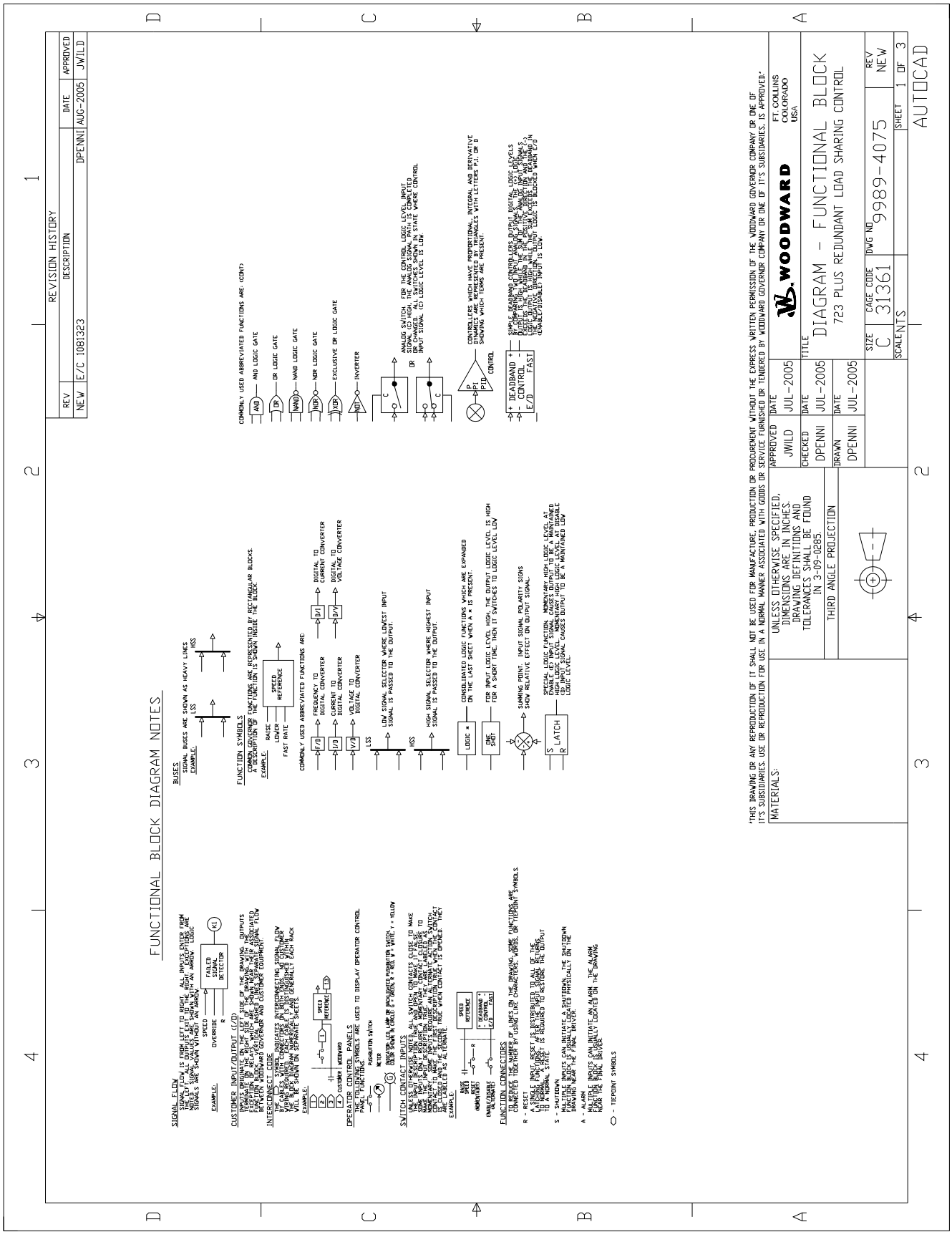
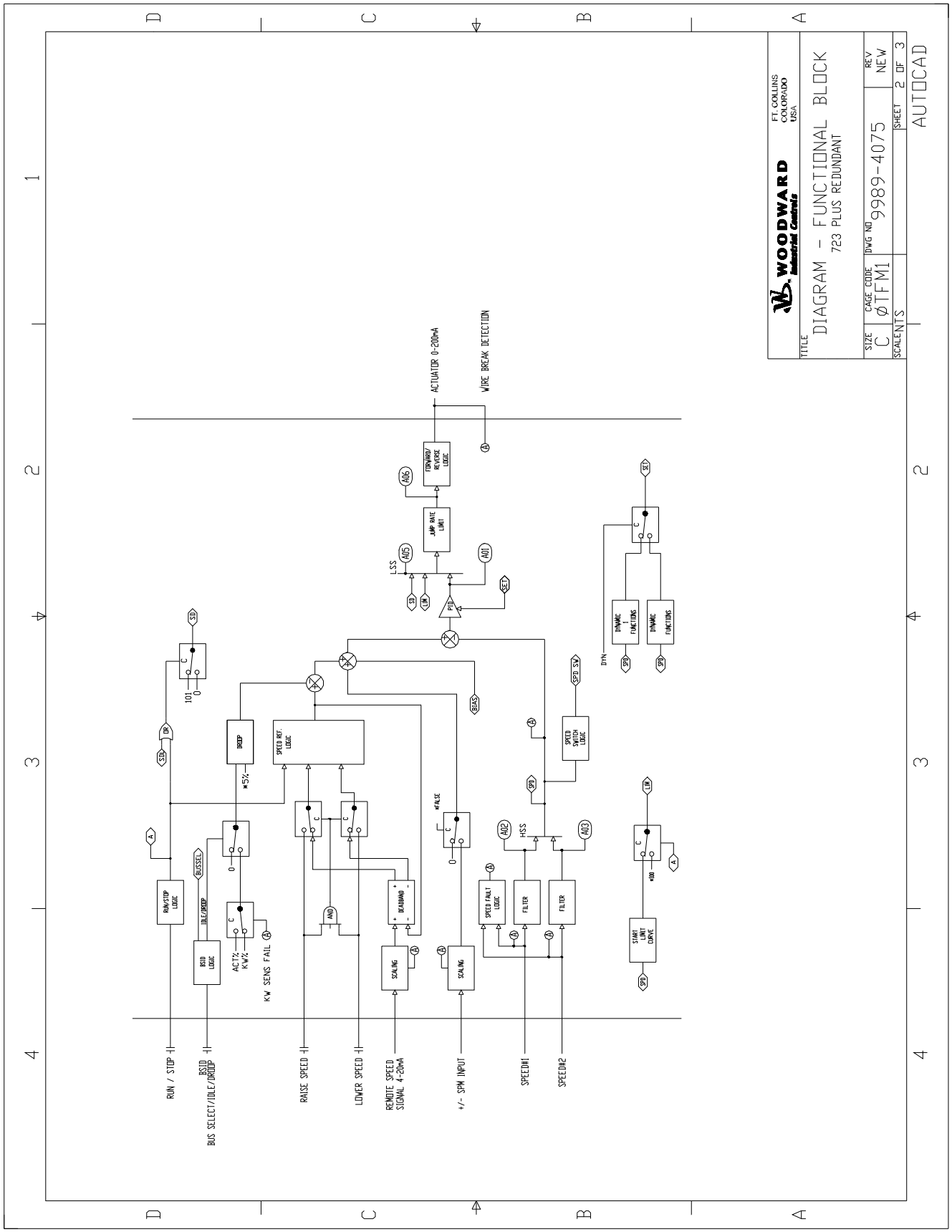
ENGINE #2 723+ CONTROL
ENGINE #3 723+ CONTROL
ENGINE #4 723+ CONTROL
ENGINE #5 723+ CONTROL
ENGINE #6 723+ CONTROL
LON #1
LON #2
WOODWARD
FT. COLLINS COLORADO USA
CONTROL WIRING DIAGRAM
723 PLUS REDUNDANT LOAD SHARING
9971-1183
CAGE CODE 0TFM1
SIZE D
SCALE NTS
SHEET 8 OF 9
REV NEW
AUTOCAD

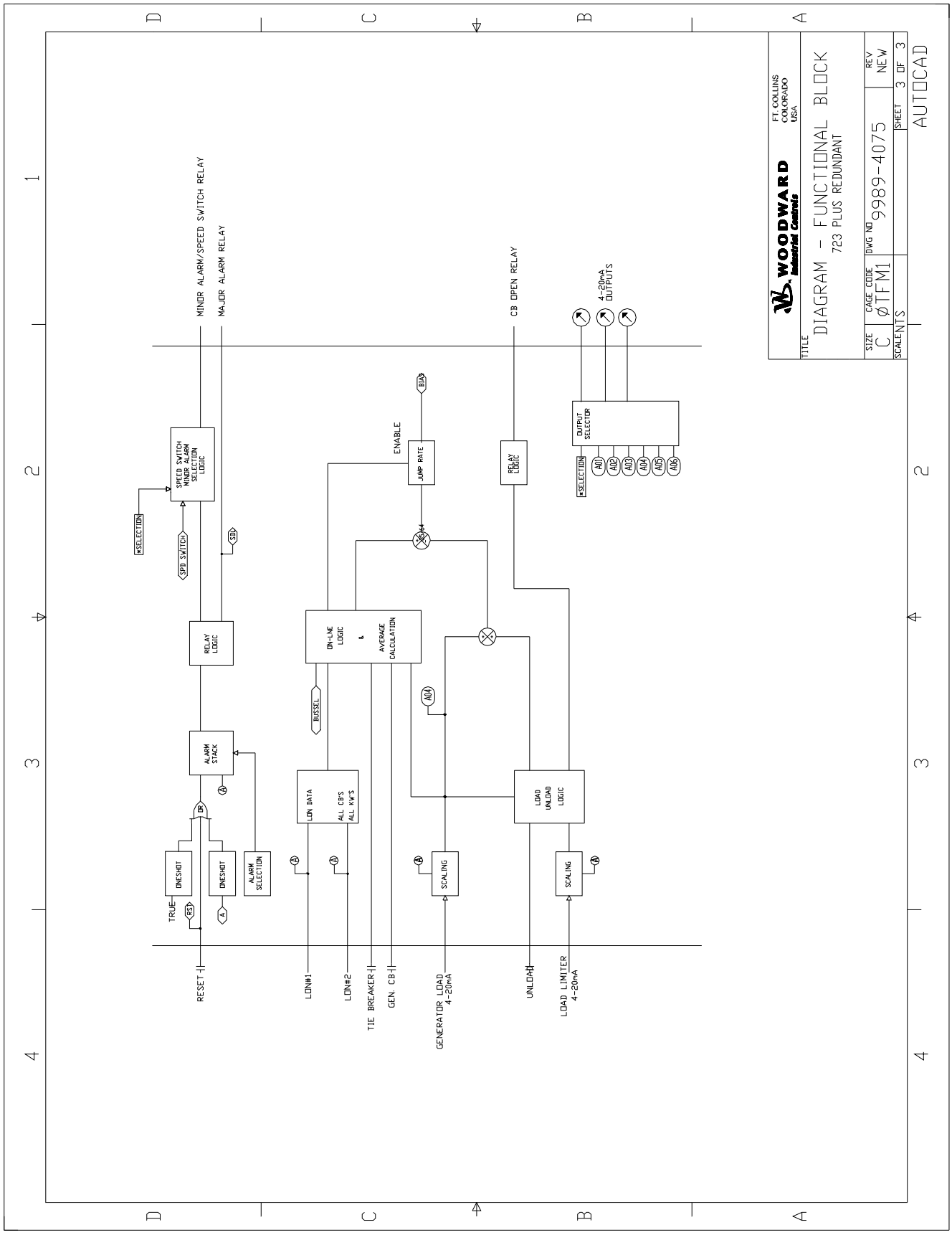

TIE BREAKER
BUS BAR #1
BUS BAR #2
CB6
CB5
CB4
CB3
CB2
CB1
MG
ENGINE #6
ENGINE #5
ENGINE #4
ENGINE #3
ENGINE #2
ENGINE #1
723 #6
723 #5
723 #4
723 #3
723 #2
723 #1
BUS SELECT 6
LON ADDRESS 6
BUS SELECT 5
LON ADDRESS 5
BUS SELECT 4
LON ADDRESS 4
BUS SELECT 3
LON ADDRESS 3
BUS SELECT 2
LON ADDRESS 2
BUS SELECT 1
LON ADDRESS 1
LON ADDRESS MUST ALL BE UNIQUE TO EACH CONTROL.
BUS SELECT CAN COME FROM SWITCH INPUT ON DISCRETE INPUT E OR FROM SETTING INSIDE CONTROL.
WOODWARD
FT. COLLINS COLORADO USA
CONTROL WIRING DIAGRAM
723 PLUS REDUNDANT LOAD SHARING
CAGE CODE 07FM1
9971-1183
REV NEW
SIZE D
SCALE NTS
SHEET 9 OF 9
AUTOCAD

Chapter 7.
Functional Block Diagram

This chapter contains Functional Block Diagram 9989-4075 (3 pages).


FUNCTIONAL BLOCK DIAGRAM NOTES
REVISION HISTORY
REV | DESCRIPTION | DATE | APPROVED
NEW | E/C 1081323 | DPENNI AUG-2005 | JWILD
SIGNAL FLOW
BUSES
FUNCTION SYMBOLS
COMMONLY USED ABBREVIATED FUNCTIONS ARE:
COMMONLY USED ABBREVIATED FUNCTIONS ARE: (CONT)
CUSTOMER INPUT/OUTPUT (I/O)
INTERCONNECT CODE
OPERATOR CONTROL PANELS
SWITCH CONTACT INPUTS
FUNCTION CONNECTORS
'THIS DRAWING OR ANY REPRODUCTION OF IT SHALL NOT BE USED FOR MANUFACTURE, PRODUCTION OR PROCUREMENT WITHOUT THE EXPRESS WRITTEN PERMISSION OF THE WOODWARD GOVERNOR COMPANY OR ONE OF IT'S SUBSIDIARIES. USE OR REPRODUCTION FOR USE IN A NORMAL MANNER ASSOCIATED WITH GOODS OR SERVICE FURNISHED OR TENDERED BY WOODWARD GOVERNOR COMPANY OR ONE OF IT'S SUBSIDIARIES, IS APPROVED.'
MATERIALS:
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. DRAWING DEFINITIONS AND TOLERANCES SHALL BE FOUND IN 3-09-0285.
THIRD ANGLE PROJECTION
APPROVED JWILD JUL-2005
CHECKED DPENNI JUL-2005
DRAWN DPENNI JUL-2005
WOODWARD
FT. COLLINS COLORADO USA
TITLE
DIAGRAM - FUNCTIONAL BLOCK
723 PLUS REDUNDANT LOAD SHARING CONTROL
SIZE C
CAGE CODE 31361
DWG NO 9989-4075
REV NEW
SCALE NTS
SHEET 1 OF 3
AUTOCAD


WOODWARD
Industrial Controls
FT. COLLINS
COLORADO
USA
TITLE
DIAGRAM - FUNCTIONAL BLOCK
723 PLUS REDUNDANT
SIZE C
CAGE CODE ØTFM1
DWG NO 9989-4075
REV NEW
SCALE NTS
SHEET 2 OF 3
AUTOCAD
ACTUATOR 0-200mA
WIRE BREAK DETECTION
FORWARD/ REVERSE LOGIC
JUMP RATE LIMIT
LSS
PID
DROOP
*5%
SPEED REF. LOGIC
BIAS
SPEED SWITCH LOGIC
SPD SW
DYNAMIC 1 FUNCTIONS
DYNAMIC FUNCTIONS
DYN
RUN/STOP LOGIC
BSID LOGIC
IDLE/DROOP
BUSSEL
ACT% KW%
KW SENS FAIL
AND
DEADBAND
SCALING
*FALSE
HSS
SPEED FAULT LOGIC
FILTER
FILTER
START LIMIT CURVE
*100
RUN / STOP
BSID SELECT/IDLE/DROOP
RAISE SPEED
LOWER SPEED
REMOTE SPEED SIGNAL 4-20mA
+/- SPM INPUT
SPEEDM1
SPEEDM2


MINOR ALARM/SPEED SWITCH RELAY
MAJOR ALARM RELAY
CB OPEN RELAY
4-20mA OUTPUTS
SPEED SWITCH MINOR ALARM SELECTION LOGIC
*SELECTION
SPD SWITCH
STD
RELAY LOGIC
ALARM STACK
ONESHOT
ONESHOT
ALARM SELECTION
TRUE
RST
RESET
ENABLE
JUMP RATE
BUS
ON-LINE LOGIC & AVERAGE CALCULATION
BUSSEL
LDN DATA
ALL CB'S ALL KW'S
LDN#1
LDN#2
TIE BREAKER
GEN. CB
SCALING
GENERATOR LOAD 4-20mA
RELAY LOGIC
LOAD UNLOAD LOGIC
UNLOAD
SCALING
LOAD LIMITER 4-20mA
OUTPUT SELECTOR
*SELECTION
A01
A02
A03
A04
A05
A06
WOODWARD
FT COLLINS COLORADO USA
TITLE
DIAGRAM - FUNCTIONAL BLOCK
723 PLUS REDUNDANT
SIZE C
CAGE CODE ØTFM1
DWG NO 9989-4075
REV NEW
SCALE NTS
SHEET 3 OF 3
AUTOCAD

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 published at **www.woodward.com/directory**.

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 (129) 4097100
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 (129) 4097100
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 (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

For the most current product support and contact information, please visit our website directory at **www.woodward.com/directory**.

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.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 26310.

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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.

2012/10/Colorado