

TABLE OF CONTENTS



Chapter 1: Getting Started

Introduction	1–2
The Purpose of this Manual	1–2
Supplemental Manuals	1–2
Technical Support	1–2
Conventions Used	1–2
Key Topics for Each Chapter	1–2
Selecting the Proper Module	1–3
DL05	1–3
DL06	1–3
Module Choices	1–3
Installing the Option Modules	1–5
Remove the Slot Cover	1–5
Insert the Module	1–5
Power Budgeting	1–6
Power supplied	1–6
Power required by base unit	1–6
Power required by option cards	1–6

Chapter 2: Discrete I/O Guidelines

Safety Guidelines	2–2
Plan for Safety	2–2
Three Levels of Protection	2–3
Emergency Stops	2–3
Emergency Power Disconnect	2–4
Orderly System Shutdown	2–4
Class 1, Division 2 Approval (Applies ONLY to modules used with a DL06 PLC.)	2–4

Table of Contents

System Wiring Strategies	2-5
PLC Isolation Boundaries	2-5
Sinking/Sourcing Concepts	2-7
I/O “Common” Terminal Concepts	2-8
Connecting DC I/O to Solid State Field Devices	2-9
Solid State Input Sensors	2-9
Solid State Output Loads	2-9
Relay Output Guidelines	2-11
Prolonging Relay Contact Life	2-11
Surge Suppression For Inductive Loads	2-12
Prolonging Relay Contact Life	2-13
DC Input Wiring Methods	2-14
DC Output Wiring Methods	2-14
Firmware and Software	2-14
I/O Addressing	2-15
Module I/O Points and Addressing for the DL05 and DL06	2-15
Discrete and Analog Modules Installed I/O Addressing Example:	2-16
Discrete and Analog Modules Installed I/O Addressing Example:	2-16
All Discrete Modules Installed I/O Addressing Example:	2-16
Discrete I/O General Specifications	2-17
Glossary of Specification Terms	2-18
F0-08SIM8-Point Simulator Input Module	2-19
D0-10ND310-Point DC Input Module	2-20
D0-10ND3F10-Point DC Fast Input Module	2-21
D0-16ND316-Point DC Input Module	2-22
F0-08NA-18-Point AC Input Module	2-23
D0-10TD110-Point DC Output Module	2-24
D0-16TD116-Point DC Output Module	2-25
D0-10TD210-Point DC Output Module	2-26
D0-16TD216-Point DC Output Module	2-27
D0-07CDR4-Point DC Input and 3-Point Relay Output Module	2-28
D0-08TR8-Point Relay Output Module	2-29
D0-08CDD14-Point DC Input and 4-Point DC Output Module	2-30
F0-04TRS4-Point Relay Output Module	2-31

Chapter 3: F0-04AD-1 4-Ch. Analog Current Input	3-1
Module Specifications	3-2
Setting the Module Jumper	3-4
Connecting and Disconnecting the Field Wiring	3-4
Wiring Guidelines	3-4
Wiring Diagram	3-5
Current Loop Transmitter Impedance	3-5
Module Operation	3-6
Channel Scanning Sequence	3-6
Analog Module Updates	3-6
Special V-memory Locations	3-7
Formatting the Module Data	3-7
DL05 Data Formatting	3-7
Structure of V7700	3-7
Structure of V7701	3-7
DL06 Data Formatting	3-8
Setup Data Type and Number of Channels	3-8
Storage Pointer Setup	3-8
Using the Pointer in Your Control Program	3-9
DL05 Pointer Method	3-9
DL06 Pointer Method	3-10
Detecting Input Signal Loss	3-11
Analog Signal Loss	3-11
Scale Conversions	3-11
Scaling the Input Data	3-11
The Conversion Program	3-12
Analog and Digital Value Conversions	3-12
Special Relays	3-13
DL05 Special Relays	3-13
DL06 SpecialRelays	3-13
Module Resolution	3-15
Analog Data Bits	3-15
Resolution Details	3-15

Table of Contents

Analog Input Ladder Logic Filter	3-16
PID Loops / Filtering:	3-16
Smoothing the Input Signal (DL06 only):	3-16
Using Binary Data Format	3-16
Using BCD Data Format	3-17
Chapter 4: F0-08ADH-1 8-Ch.Analog Current Input	4-1
Module Specifications	4-2
Connecting and Disconnecting the Field Wiring	4-4
Wiring Guidelines	4-4
Wiring Diagram	4-5
Current Loop Transmitter Impedance	4-5
Module Operation	4-6
Channel Scanning Sequence	4-6
Analog Module Updates	4-6
Special V-memory Locations	4-7
Formatting the Analog Module Data	4-7
DL05 Data Formatting	4-7
Setup Data Type and Number of Active Channels	4-7
Storage Pointer Setup	4-7
DL06 Data Formatting	4-8
Setup Data Type and Number of Active Channels	4-8
Storage Pointer Setup	4-8
Using the Pointer in Your Control Program	4-9
DL05 Pointer Method Using Conventional Ladder Logic	4-9
DL05 Pointer Method Using the IBox Instruction Available in DirectSOFT5	4-9
DL06 Pointer Method Using Conventional Ladder Logic	4-10
DL06 Pointer Method Using the IBox Instruction Available in DirectSOFT5	4-11
Scale Conversions	4-11
Scaling the Input Data	4-11
The Conversion Program in Standard Ladder Logic	4-12
Analog and Digital Value Conversions	4-13

Module Resolution	4-14
Analog Data Bits	4-14
Resolution Details	4-14
Analog Input Ladder Logic Filter	4-15
PID Loops / Filtering:	4-15
Smoothing the Input Signal (DL06 only):	4-15
Binary Data Format Filter Using Ladder Logic	4-15
BCD Data Format Filter Using Ladder Logic	4-16
Example Code to Scale a 4–20mA Signal to 0–1000 BCD	4-17
Example Code to Scale a 4–20mA Signal to 0–1000 Binary	4-18
Chapter 5: F0-04AD-2 4-Ch. Analog Voltage Input	5-1
Module Specifications	5-2
Setting the Module Jumpers	5-4
Connecting and Disconnecting the Field Wiring	5-5
Wiring Guidelines	5-5
Wiring Diagram	5-5
Module Operation	5-6
Input Channel Update Sequence	5-6
Analog Module Updates	5-6
Special V-memory Locations	5-7
Formatting the Module Data	5-7
DL05 Data Formatting	5-7
Structure of V7700	5-7
Structure of V7701	5-7
DL06 Data Formatting	5-8
Setup Data Type and Number of Channels	5-8
Storage Pointer Setup	5-8
Using the Pointer in Your Control Program	5-9
DL05 Pointer Method	5-9
DL06 Pointer Method	5-10

Table of Contents

Scale Conversions	5-11
Scaling the Input Data	5-11
The Conversion Program	5-12
Analog and Digital Value Conversions	5-13
Module Resolution	5-14
Analog Data Bits	5-14
Resolution Details	5-14
Analog Input Ladder Logic Filter	5-15
PID Loops / Filtering:	5-15
Smoothing the Input Signal (DL06 only):	5-15
Using Binary Data Format	5-15
Using BCD Data Format	5-16
Chapter 6: F0-08ADH-2 8-Ch.Analog Voltage Input	6-1
Module Specifications	6-2
Locating the jumpers	6-4
Setting the appropriate jumper	6-4
Setting the Module Jumpers	6-4
Connecting and Disconnecting the Field Wiring	6-5
Wiring Guidelines	6-5
Wiring Diagram	6-6
Module Operation	6-7
Channel Scanning Sequence	6-7
Analog Module Updates	6-7
Special V-memory Locations	6-8
Formatting the Analog Module Data	6-8
DL05 Data Formatting	6-8
Setup Data Type and Number of Active Channels	6-8
Storage Pointer Setup	6-8
DL06 Data Formatting	6-9
Setup Data Type and Number of Active Channels	6-9
Storage Pointer Setup	6-9

Using the Pointer in Your Control Program	6-10
DL05 Pointer Method Using Conventional Ladder Logic	6-10
DL05 Pointer Method Using the IBox Instruction Available in DirectSOFT5	6-10
DL06 Pointer Method Using Conventional Ladder Logic	6-11
DL06 Pointer Method Using the IBox Instruction Available in DirectSOFT5	6-12
Scale Conversions	6-12
Scaling the Input Data	6-12
The Conversion Program in Standard Ladder Logic	6-13
Analog and Digital Value Conversions	6-14
Module Resolution	6-15
Analog Data Bits	6-15
Resolution Details	6-15
Analog Input Ladder Logic Filter	6-16
PID Loops / Filtering:	6-16
Smoothing the Input Signal (DL06 only):	6-16
Binary Data Format Filter Using Ladder Logic	6-16
Using BCD Data Format	6-17
Chapter 7: F0-04DAH-1 4-Ch.Analog Current Output	7-1
Module Specifications	7-2
Connecting and Disconnecting the Field Wiring	7-4
Wiring Guidelines	7-4
Wiring Diagram	7-5
Module Operation	7-6
Channel Scanning Sequence	7-6
Special V-memory Locations	7-7
Formatting the Analog Module Data	7-7
DL05 Data Formatting	7-7
Data Type and Number of Active Channels Setup	7-7
Storage Pointer Setup	7-7
DL06 Data Formatting	7-8
Data Type and Number of Active Channels Setup	7-8
Storage Pointer Setup	7-8

Table of Contents

Using the Pointer in Your Control Program	7-9
DL05 Pointer Method Using Conventional Ladder Logic	7-9
DL05 Pointer Method Using the IBox Instruction Available in DirectSOFT5	7-9
DL06 Pointer Method Using Conventional Ladder Logic	7-10
DL06 Pointer Method Using the IBox Instruction Available in DirectSOFT5	7-11
Output Scale Conversion	7-11
Calculating the Digital Output Value	7-11
The Conversion Program in Standard Ladder Logic	7-12
Analog and Digital Value Conversions	7-13
Module Resolution	7-14
Analog Data Bits	7-14
Resolution Details	7-14
Chapter 8: F0-08DAH-1 8-Ch.Analog Current Output	8-1
Module Specifications	8-2
Connecting and Disconnecting the Field Wiring	8-4
Wiring Guidelines	8-4
Wiring Diagram	8-5
Module Operation	8-6
Channel Scanning Sequence	8-6
Special System V-memory Locations	8-7
Formatting the Analog Module Data	8-7
DL05 Data Formatting	8-7
Data Type and Number of Active Channels Setup	8-7
Storage Pointer Setup	8-7
DL06 Data Formatting	8-8
Data Type and Number of Active Channels Setup	8-8
Storage Pointer Setup	8-8
Using the Pointer in Your Control Program	8-9
DL05 Pointer Method Using Conventional Ladder Logic	8-9
DL05 Pointer Method Using the IBox Instruction Available in DirectSOFT5	8-9
DL06 Pointer Method Using Conventional Ladder Logic	8-10
DL06 Pointer Method Using the IBox Instruction Available in DirectSOFT5	8-11

Output Scale Conversion	8-11
Calculating the Digital Output Value	8-11
The Conversion Program in Standard Ladder Logic	8-12
Analog and Digital Value Conversions	8-13
Module Resolution	8-14
Analog Data Bits	8-14
Resolution Details	8-14
Chapter 9: F0-04DAH-2 4-Ch.Analog Voltage Output	9-1
Module Specifications	9-2
Connecting and Disconnecting the Field Wiring	9-4
Wiring Guidelines	9-4
Wiring Diagram	9-5
Module Operation	9-6
Channel Scanning Sequence	9-6
Special V-memory Locations	9-7
Formatting the Analog Module Data	9-7
DL05 Data Formatting	9-7
Data Type and Number of Active Channels Setup	9-7
Storage Pointer Setup	9-7
DL06 Data Formatting	9-8
Data Type and Number of Active Channels Setup	9-8
Storage Pointer Setup	9-8
Using the Pointer in Your Control Program	9-9
DL05 Pointer Method Using Conventional Ladder Logic	9-9
DL05 Pointer Method Using the IBox Instruction Available in DirectSOFT5	9-9
DL06 Pointer Method Using Conventional Ladder Logic	9-10
DL06 Pointer Method Using the IBox Instruction Available in DirectSOFT5	9-11
Output Scale Conversion	9-11
Calculating the Digital Output Value	9-11
The Conversion Program in Standard Ladder Logic	9-12
Analog and Digital Value Conversions	9-13

Table of Contents

Module Resolution	9-14
Analog Data Bits	9-14
Resolution Details	9-14
Chapter 10: F0-08DAH-2 8-Ch.Analog Voltage Output	10-1
Module Specifications	10-2
Connecting and Disconnecting the Field Wiring	10-4
Wiring Guidelines	10-4
Wiring Diagram	10-5
Module Operation	10-6
Channel Scanning Sequence	10-6
Special V-memory Locations	10-7
Formatting the Analog Module Data	10-7
DL05 Data Formatting	10-7
Data Type and Number of Active Channels Setup	10-7
Storage Pointer Setup	10-7
DL06 Data Formatting	10-8
Data Type and Number of Active Channels Setup	10-8
Storage Pointer Setup	10-8
Using the Pointer in Your Control Program	10-9
DL05 Pointer Method Using Conventional Ladder Logic	10-9
DL05 Pointer Method Using the IBox Instruction Available in DirectSOFT5	10-9
DL06 Pointer Method Using Conventional Ladder Logic	10-10
DL06 Pointer Method Using the IBox Instruction Available in DirectSOFT5	10-11
Output Scale Conversion	10-11
Calculating the Digital Output Value	10-11
The Conversion Program in Standard Ladder Logic	10-12
Analog and Digital Value Conversions	10-13
Module Resolution	10-14
Analog Data Bits	10-14
Resolution Details	10-14

Chapter 11: F0-4AD2DA-1 4-Ch. In/2-Ch. Out Analog Current Combination	11-1
Module Specifications	11-2
Setting the Module Jumper	11-4
Connecting and Disconnecting the Field Wiring	11-5
Wiring Guidelines	11-5
Wiring Diagram	11-6
Module Operation	11-7
Input/Output Channel Update Sequence	11-7
Analog Module Updates	11-7
Special V-memory Locations	11-8
Formatting the Module Data	11-8
DL05 Data Formatting	11-8
Structure of V7700	11-8
Structure of V7701	11-8
Structure of V7702	11-9
DL06 Data Formatting	11-10
Setup Data Type and Number of Channels	11-10
Input Storage Pointer Setup	11-10
Output Storage Pointer Setup	11-10
Using the Pointer in Your Control Program	11-11
DL05 Pointer Method	11-11
DL06 Pointer Method	11-12
Scale Conversions	11-13
Scaling the Input Data	11-13
The Conversion Program	11-14
Output Conversion Program	11-14
Analog and Digital Value Conversions	11-15
Module Resolution	11-16
Analog Data Bits	11-16
Resolution Details	11-16

Table of Contents

Analog Input Ladder Logic Filter	11-17
PID Loops / Filtering:	11-17
Smoothing the Input Signal (DL06 only):	11-17
Using Binary Data Format	11-17
Using BCD Data Format	11-18
Chapter 12: F0-2AD2DA-2 2-Ch. In/2-Ch. Out	
Analog Voltage Combination	12-1
Module Specifications	12-2
Setting the Module Jumpers	12-4
Connecting and Disconnecting the Field Wiring	12-5
Wiring Guidelines	12-5
Wiring Diagram	12-5
Module Operation	12-6
Input/Output Channel Scanning Sequence	12-6
Analog Module Updates	12-6
Special V-memory Locations	12-7
Formatting the Module Data	12-7
DL05 Data Formatting	12-7
Structure of V7700	12-7
Structure of V7701	12-7
Structure of V7702	12-8
DL06 Data Formatting	12-9
Setup Data Type and Number of Channels	12-9
Input Storage Pointer	12-9
Output Storage Pointer	12-9
Using the Pointer in Your Control Program	12-10
DL05 Pointer Method	12-10
DL06 Pointer Method	12-11
Scale Conversions	12-12
Scaling the Input Data	12-12
The Conversion Program	12-13
Output Conversion Program	12-13
Analog and Digital Value Conversions	12-14

Module Resolution	12-15
Analog Data Bits	12-15
Analog Input Ladder Logic Filter	12-16
PID Loops / Filtering:	12-16
Smoothing the Input Signal (DL06 only):	12-16
Using Binary Data Format	12-16
Using BCD Data Format	12-17
Chapter 13: F0-4AD2DA-2 4-Ch. In/2-Ch. Out	
Analog Voltage Combination	13-1
Module Specifications	13-2
Setting the Module Jumpers	13-4
Connecting and Disconnecting the Field Wiring	13-5
Wiring Guidelines	13-5
Wiring Diagram	13-5
Module Operation	13-6
Input/Output Channel Update Sequence	13-6
Analog Module Updates	13-6
Special V-memory Locations	13-7
Formatting the Module Data	13-7
DL05 Data Formatting	13-7
Structure of V7700	13-7
Structure of V7701	13-7
Structure of V7702	13-8
DL06 Data Formatting	13-9
Setup Data Type and Number of Channels	13-9
Input Storage Pointer Setup	13-9
Output Storage Pointer Setup	13-9
Using the Pointer in Your Control Program	13-10
DL05 Pointer Method	13-10
DL06 Pointer Method	13-11

Table of Contents

Scale Conversions	13-12
Scaling the Input Data	13-12
The Conversion Program	13-13
Output Conversion Program	13-13
Analog and Digital Value Conversions	13-14
Module Resolution	13-15
Analog Data Bits	13-15
Resolution Details	13-15
Analog Input Ladder Logic Filter	13-16
PID Loops / Filtering:	13-16
Smoothing the Input Signal (DL06 only):	13-16
Using Binary Data Format	13-16
Using BCD Data Format	13-17
Chapter 14: F0-04RTD 4-ChannelRTD Input	14-1
Module Specifications	14-2
Module Calibration	14-3
Input Specifications	14-3
Connecting and Disconnecting the Field Wiring	14-4
Wiring Guidelines	14-4
RTD - Resistance Temperature Detector	14-4
Ambient Variations in Temperature	14-5
Wiring Diagram	14-5
Module Operation	14-6
Channel Scanning Sequence	14-6
Analog Module Update	14-6
Special V-memory Locations	14-7
Module Configuration Registers	14-7
A: Number of Channels Enabled/Data Format Register	14-7
B: Input Pointer Register	14-8
C: RTD Type Selection Register	14-8
D: Units Code Register	14-9
E: RTD Burnout Data Value Register	14-10
F: Diagnostics Error Register	14-10

Configuring the Module in Your Control Program	14-11
DL05 Example 1	14-11
DL05 Example 2	14-12
DL06 Example 1	14-13
DL06 Example 2	14-14
Negative Temperature Readings with Magnitude Plus Sign	14-15
Magnitude Plus Sign (Binary)	14-15
Magnitude Plus Sign (BCD)	14-16
Negative Temperatures 2's Complement (Binary/Pointer Method)	14-17
Analog Input Ladder Logic Filter	14-18
PID Loops / Filtering:	14-18
Smoothing the Input Signal (DL06 only):	14-18
Using Binary Data Format	14-18
Using BCD Data Format	14-19
RTD Burnout Detection Bits	14-20
Special Relays Corresponding to RTD Burnouts	14-20
Chapter 15: F0-04THM 4-Channel Thermocouple Input	15-1
Module Specifications	15-2
Connecting and Disconnecting the Field Wiring	15-4
Wiring Guidelines	15-4
Thermocouple Input Wiring Diagram	15-4
Thermocouples	15-5
Ambient Variations in Temperature	15-5
Voltage Input Wiring Diagram	15-6
Module Operation	15-7
Channel Scanning Sequence	15-7
Analog Module Update	15-7

Table of Contents

Special V-memory Locations	15–8
Module Configuration Registers	15–8
A: Number of Channels Enabled/Data Format Register	15–8
B: Input Pointer Register	15–9
C: Input Type Selection Register	15–9
D: Units Code Register	15–10
E: Thermocouple Burnout Detection Enable Register	15–11
F: Thermocouple Burnout Data Value Register	15–11
G: Diagnostics Error Register	15–11
Configuring the Module in Your Control Program	15–12
DL05 Example 1	15–12
DL05 Example 2	15–13
DL06 Example 1	15–14
DL06 Example 2	15–15
Negative Temperature Readings with Magnitude Plus Sign	15–16
Magnitude Plus Sign (Binary)	15–16
Magnitude Plus Sign (BCD)	15–17
Module Resolution	15–18
Module Resolution 16-Bit (Unipolar Voltage Input)	15–18
Module Resolution 15-Bit Plus Sign (Bipolar Voltage Input)	15–18
Analog Input Ladder Logic Filter	15–19
PID Loops / Filtering:	15–19
Smoothing the Input Signal (DL06 only):	15–19
Using Binary Data Format	15–19
Using BCD Data Format	15–20
Thermocouple Burnout Detection Bits	15–21
Special Relays Corresponding to Thermocouple Burnouts	15–21