WES/RS232/Reliance Interface User's Guide

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Section 1. Introduction

1-1. Overview

This document describes the operation of the WEStation/RS-232/Reliance™ Programmable Controller Interface, hereafter referred to as the Reliance Interface.

The Reliance Interface provides a link between the WDPF® Westnet II™ Data Highway and Reliance Electric programmable logic controllers (PLCs). The interface software will run on any WEStation with an available RS-232 serial device driver.

The Reliance Interface can communicate with a Reliance gateway, a redundant pair of Reliance gateways, or directly to a Reliance processor. Supported Reliance processor types include: Automate™15, 15E, Automate 20, 20E, Automate 30, 30E, and Automate 40, 40E.

The Reliance Interface is the functional equivalent of the Reliance PLC link on the existing Universal Programmable Controller Interface (UPCI). For more information on the UPCI, refer to the "Universal Programmable Controller Interface User's Guide" (U0-1960).

The Reliance Interface performs the following functions:

- Reads register data from the Reliance PLCs and writes the data to WDPF process points, either periodically or through unsolicited write commands from the PLCs.
- Writes WDPF process point data to the Reliance PLC registers, either periodically or when process point values change.
- Accepts operator general purpose message (GPM) commands to change data in the PLCs.

1-2. Contents of this Document

This document is organized into the following sections:

Section 1. Introduction provides an overview of the Reliance Interface.

Section 2. Hardware Configuration describes the hardware required for the Reliance Interface.

Section 3. Software Configuration describes the software configuration files for the Reliance Interface.

Section 4. Interface Functions describes the data exchange functions of the Reliance Interface.

Section 5. Startup and Interface Operations discusses startup and operation of the Reliance Interface software.

Appendix A. Sample Graphics Problem-Oriented Language (POL) Program describes a sample POL program.

1-3. Reference Documents

Additional reference documents that may be useful are listed in Table 1-1.

Table 1-1. Reference Documents

Document Number	Title	Description
M0-0003	Self-Test Diagnostics	Describes the self-test diagnostics incorporated in the WDPF system.
U0-0131	Record Types User's Guide	Describes point, system, and algorithm record types, and purpose and use of the records. Memory and performance capabilities for point records are also discussed.
U0-1960	Universal Programmable Controller Interface User's Guide	Describes UPCI hardware, compiler, and basic operation of the UPCI.
U0-8100	Operator WEStation User's Guide	Describes use of windows for viewing and controlling the current status of plant process control systems.
U0-8200	Engineering WEStation User's Guide	Discusses Engineering WEStation functions (also known as the Software Development Station) for development and maintenance of application and system hardware.
U0-8700	WEStation Data Link Server User's Guide	Describes configuration and operation of the WEStation Data Link Server, the Data Link Manager, and startup and shutdown.
J3091PB	AutoMate Communication Manual	Reliance Electric's Automate communication instruction manual.

Section 2. Hardware Configuration

2-1. Section Overview

This section describes the hardware used by the Reliance Interface. The following components are described:

- WEStation with an RS-232 Serial Port (Section 2-2)
- Data Link Server (Section 2-3)
- Optional Card for Additional Serial Ports (Section 2-4)
- Interface Configuration (Section 2-5)

The WEStation connects to a Reliance PLC or a Reliance Gateway through an RS-232 serial link. The gateway communicates with one or more Reliance PLCs via R-Net™. (R-Net is the communication protocol defined by Reliance.) For more information on R-Net, refer to Reliance Electric publication, “AutoMate Communication Manual” (J3091PB). Multiple instances of the Reliance Interface process can reside on a single machine to support multiple connections.

2-2. WEStation with RS-232 Serial Port

The Reliance Interface software will run on any WEStation with an available RS-232 serial device driver.

A WEStation normally has two serial devices: /dev/ttya and /dev/ttyb. More serial devices can be provided by adding communication hardware such as the Central Data serial controller board.

The Reliance Interface requires a text editor to create the configuration files that define the point groups and port attributes. Any WEStation equipped with a text editor can be used to perform this task (for example, an Engineering WEStation, also known as a Software Development Station).

Note

An Engineering WEStation provides direct access to the applicable operating system, other drops, and the Westnet II Data Highway. Therefore, it is assumed that the user has a thorough understanding of the functionality of the WDPF systems and the operating system commands before using the Engineering WEstation functions (as described in "Engineering WEStation User's Guide" (U0-8200)).

2-3. Data Link Server

The name Data Link Server (DLS) refers to a WEStation that is running data link subsystems and is connected to the Ethernet Information Highway and the WDPF Westnet II Data Highway. Its purpose is to accept and maintain a communication link from the client (remote computer device). The client uses this link to access information from the WDPF process control system. Process point information can be read from or originated to the Westnet II Data Highway.

The DLS operates on lists of process point names. These are referred to as point groups. A point group can be predefined in a configuration file, or it can be listed by the client in the request message. The DLS can be requested to do the following:

- Originate point data to the Westnet II Data Highway.
- Periodically collect and transmit point data (point value and status).
- Return information such as current point data, historical point data, point attributes, and the system time.

The DLS executable files and the configuration files are maintained at the Software Server.

For additional information regarding the WEStation Data Link Server and its functions, refer to the "WEStation Data Link Server User's Guide" (U0-8700).

2-4. Optional Card for Additional Serial Ports

A WEStation can be ordered with the optional Central Data serial controller board to supply up to sixteen additional serial devices.

The Sun™ Microsystem Serial Parallel Controller card can be used to supply up to eight additional serial ports to the WEStation.

2-5. Interface Configuration

There are three possible configurations for the Reliance interface: Single Gateway Configuration, Redundant Gateway Configuration, and Direct Connection to a Reliance PLC. Each configuration supports process redundancy.

2-5.1. Single Gateway Configuration

Single gateway configuration refers to a single RS-232 connection between the WEStation and a Reliance gateway. The Reliance gateway can communicate with multiple Reliance PLCs via R-Net. The **DL.PLC.x.NumberGateways** parameter in the CONFIG.DL file is set to 1.

2-5.2. Redundant Gateway Configuration

The Reliance Interface process can be configured to use two redundant Reliance gateways. This configuration uses a , **primary** gateway and an **auxiliary** gateway, and a separate serial link from the WDPF drop to each. If this configuration is used, then an auxiliary port name is defined in the CONFIG.DL file. The Reliance Interface normally communicates with the gateway connected to the primary serial device. If the process is unable to communicate with the primary gateway, then an attempt is made to communicate with the auxiliary gateway through the auxiliary serial port. The **DL.PLC.x.NumberGateways** parameter in CONFIG.DL is set to 2.

2-5.3. Direct Connection to a Reliance PLC

The Reliance Interface can communicate directly with a Reliance processor if the processor contains a serial communication module. The **DL.PLC.x.NumberGateways** parameter is set to 0.

2-5.4. Process Redundancy

The Reliance interface process supports process redundancy. In this configuration, two WEStations are configured to run the same subsystem. A redundancy arbitrator process determines which subsystem is **active** and which is **backup**. The backup process is shut down. The redundancy arbitrator sets the appropriate process points to be originated by the drop that contains the active subsystem. The same process points are set to be received by the drop that contains the backup subsystem.

When a redundant subsystem detects an unrecoverable error, it aborts, causing a switchover to the backup subsystem. This is detected by the redundancy arbitrator and the process points are set to be received. This causes the points to time out, and in turn, this is detected by the redundancy arbitrator on the partner drop. The redundancy arbitrator on the partner drop sets the points to be originated and starts the subsystem.

The **DL.PLC.x.Redundant** parameter in the CONFIG.DL file indicates to the arbitrator process that the link is redundant. If this parameter flag is set to TRUE in the CONFIG.DL file, the interface will exit when it has exceeded the maximum number of communication errors. (Refer to Section 3-3 for more information about the CONFIG.DL file.)

The **originated** field in the point group file (PLC.GROUP) determines if the points are set to be originated or received when a switchover occurs. (Refer to Section 3-4 for more information about the PLC.GROUP file.)

Section 3. Software Configuration

3-1. Section Overview

The Reliance Interface maps WDPF process points to Reliance PLC registers. Data can be transferred from the PLC to the process points, or from the process points to the PLC. The process point types can be analog, digital, packed group (GP), or packed group alarm (BN). Refer to Record Types User's Guide (U0-0131) for more information on point types.

The Reliance Interface uses two separate configuration files: the CONFIG.DL configuration file and the PLC.GROUP (point group) configuration file (described in Section 3-3 and Section 3-4, respectively).

This section describes the following:

- System Setup (Section 3-2)
- CONFIG.DL File (Section 3-3)
- PLC.GROUP File (Section 3-4)
- Executable File (Section 3-5)

3-2. System Setup

This section describes the Reliance Interface directory structure.

3-2.1. Directory Structure for the Interface Software

The directory structure for the Reliance Interface is as follows:

The subdirectory **dl** is located under the **$(WDPF_HOME)** directory. The environment variable, **$WDPF_HOME**, is defined by the software package. It is usually set to **/usr/wdpf**.

The directory **$(WDPF_HOME)/dl** contains the following three subdirectories:

- **init**
- **config**
- **bin**

The **$(WDPF_HOME)/dl/init** directory contains the startup and shutdown script files as follows:

- **startup.dl**
- **start_datalinks**
- **shutdown.dl**

The **$(WDPF_HOME)/dl/config** directory contains the configuration and point group files, as follows:

- **CONFIG.DL** (configuration file) - see Section 3-3
- **PLC.GROUP** (point group file) - see Section 3-4

The **$(WDPF_HOME)/dl/bin** directory contains the binary executable, as follows:

- **dl_reliance** - see Section 3-5

The installation procedure will install the files in the correct directories.

3-3. CONFIG.DL File

The Data Link Configuration File (CONFIG.DL) defines the parameters of the data links and the diagnostic points that are used to report the current status of the link. It defines attributes such as point group configuration file name, port name, auxiliary port name, baud rate, number of retries, and communication time-outs. The CONFIG.DL file also defines the connection configuration: link to a Reliance Gateway, redundant gateway link, or direct connection to a PLC.

The CONFIG.DL file is stored on any WEStation that displays the Data Link Server (DLS) Manager. The DLS Manager is a user interface window program that contains a scrolling list of all the data link subsystems on the DLS station. The CONFIG.DL file is used to identify the name of each link and its associated link status point. The DLS Manager uses the status point of each data link subsystem to display its current status. For more information about the DLS Manager and the CONFIG.DL file, refer to the "WEStation Data Link Server User's Guide" (U0-8700).

If multiple copies of the Reliance Interface are run, then there should be multiple entries. The entries should be labeled DL.PLC.1, DL.PLC.2, etc. If different point group files are to be used, then the DL.PLC.x.PointGroupDefFile entriy should be unique for each of the different point group files.

Table 3-1 defines the parameters in a Reliance Interface CONFIG.DL file, where x = the link name.

Table 3-1. Reliance Interface Configuration File Parameters

Parameter	Description	Valid Option	Default
DL.PLC.x. DeviceName	Name of the RS-232 serial device	Up to 20 characters	/dev/ttyb
DL.PLC.x. BaudRate	Defines the data transmission rate for RS-232 communication	600, 1200, 2400, 4800, 9600, 19200, 38400	9600
DL.PLC.x. StopBits	Sets the RS-232 communication stop bits	1 or 2	2
DL.PLC.x. Parity	Sets the RS-232 communication parity	0 (None) 1 (Odd) 2 (Even)	0 No Parity
DL.PLC.x. CharSize	RS-232 communication character size	7 or 8	8

Table 3-1. Reliance Interface Configuration File Parameters (Cont'd)

Parameter	Description	Valid Option	Default
DL.PLC.x. ACKTimeout	ACK timeout in milliseconds	0 - 5000	1000
DL.PLC.x. Redundant	Causes the process to exit if communication fails	TRUE FALSE	FALSE
DL.PLC.x. NodeNumber	Source address of Reliance message	Integer	0
DL.PLC.x. NumberGateways	Number of Reliance gateways	0 (connected to PLC) 1 (1 gateway) 2 (redundant gateways)	1
DL.PLC.x. NumberRetries	Number of times a message is resent before communication failure is declared	0 - 10	2
DL.PLC.x. MessageTimeout	Number of milliseconds to wait for response	Integer	5000
DL.PLC.x. MaxCommErrors	Number of consecutive errors before communication fault is declared	Integer	5
DL.PLC.x. SyslogPriority	Priority of status messages to GMD	3 - 7 where: 3 = error 7 = debug	3
DL.PLC.x. Configuration	Defines gateway retry timeout. This is a field in the ConfigureGateway command.	0 (0.2 sec) 1 (0.5 sec) 2 (0.8 sec) 6 (2.0 sec) 15 (4.7 sec)	2
DL.PLC.x. NumberNodes	Number of Reliance nodes in system	Integer	20
DL.PLC.x. AuxDeviceName	Name of RS-232 auxiliary serial device	Up to 20 characters	None
DL.PLC.x. AuxNodeNumber	Auxiliary source	Integer	0
DL.PLC.x. LinkName	Defines subsystem name	Up to 16 character string	None

Table 3-1. Reliance Interface Configuration File Parameters (Cont'd)

Parameter	Description	Valid Option	Default
DL.PLC.x. LocalHost	Defines the local station name	For example, drop160	None
DL.PLC.x. PointGroupDefFile	Defines the process point to register configuration file	Any valid file name; must be in correct directory	PLC.GROUP
DL.PLC.x. LinkStatusPoint	Defines the status point name	Name of originated PB point	None
DL.PLC.x. LastCommPoint	Indicates the date and time of the last successful communication message between WDPF process points and the Reliance PLC	Name of originated analog point	None
DL.PLC.x. RestartProcedure	Defines the restart procedure (used by the DLS Manager)	$WDPF_HOME/ dl/bin/dl_reliance	None
DL.PLC.x. EndMessageTime	An End of Message is assumed if no characters are received for this number of milliseconds	Integer	100
*DL.PLC.x. DigitalAlarmPoint0	This digital point is set to 1 when the main device is alive	Digital point name	None
DL.PLC.x. RedundancyPoint	This digital point is required for process redundancy	Digital point name	None
*DL.PLC.x. DigitalAlarmPoint1	This digital point is set to 1 when the auxiliary port is alive	Digital point name	None
*DL.PLC.x. ErrorCountPoint0	This analog point is incremented when a communication error occurs	Analog point name	None
* - Optional			

Figure 3-1 is an example of a CONFIG.DL file used by the Reliance Interface. Comment lines are indicated by semicolons (;). No comments are permitted on the same line as an argument.

```
; Name for link displayed on the DLS Manager
DL.PLC.1.LinkName          : Reliance PLC

; Hostname of Data Link Server WEStation
DL.PLC.1.LocalHost           : drop83

; Name of point group configuration file
DL.PLC.1.PointGroupDefFile   : PLC.GROUP

; Priority of status messages sent to GMD
DL.PLC.1.SyslogPriority    : 3

; Main serial device parameters
DL.PLC.1.DeviceName        : /dev/ttyc01
DL.PLC.1.BaudRate            : 19200
DL.PLC.1.CharSize            : 8
DL.PLC.1.StopBits            : 1
; 0 = no parity, 1 = odd, 2 = even
DL.PLC.1.Parity              : 0

; Monitored by the DLS Manager to display status
DL.PLC.1.LinkStatusPoint     : PB1002A

; Monitored by the DLS Manager to display transmit time
DL.PLC.1.LastCommPoint     : AL1002A

; Used by the DLS Manager to restart link process
DL.PLC.1.RestartProcedure    : $WDPF_HOME/dl/bin/dl_reliance -l 1

; 0 = connected to PLC, 1 = one gateway, 2 = redundant gateways
DL.PLC.1.NumberGateways      : 2

; Character timeout in milliseconds to determine EOM
DL.PLC.1.EndMessageTime    : 150

; Reliance node number
DL.PLC.1.NodeNumber          : 0

; Number of Reliance nodes in system
DL.PLC.1.NumberNodes         : 8

; Parameter sent to gateway in configuration message
DL.PLC.1.Configuration       : 1

; ACK timeout in milliseconds
DL.PLC.1.ACKTimeout        : 600
```

Figure 3-1. Example of CONFIG.DL File

```
; Response message timeout in milliseconds
DL.PLC.1.MessageTimeout    : 3000

; Retransmit message this many times after timeout.
; A communication error is declared if retries fail.
DL.PLC.1.NumberRetries     : 2

; Declare a communication failure after this many errors.
; This produces a drop fault.  The process will try to
; re-establish communication or will exit depending on the
; value of the Redundant parameter.
DL.PLC.1.MaxCommErrors     : 5

; The process exits if this is set TRUE and communication fails.
DL.PLC.1.Redundant         : FALSE

; Used for process redundancy
; If the link process exits then this point will time out
; and trigger a failover to the link process on the partner drop.
;The partner link process configures the same redundancy point.DL.PLC.1.RedundancyPoint
: PLCDI123

; Used if NumberGateways = 2
DL.PLC.1.AuxDeviceName      : /dev/ttyc02
DL.PLC.1.AuxNodeNumber      : 1

; Set to 1 if main port is able to communicate
DL.PLC.1.DigitalAlarmPoint0   DL2020B

; Set to 1 if auxiliary port is able to communicate
DL.PLC.1.DigitalAlarmPoint1 : DL8300B

; Increments when a communication error is observed.
; This is never cleared by the link
DL.PLC.1.ErrorCountPoint0   : AL8340B
```

Figure 3-1. Example of CONFIG.DL File (Con't.)

3-4. PLC Group File

The PLC.GROUP file maps Reliance programmable controller registers with WDPF process points. It defines a time interval for each periodic group and determines whether data is sent to or from the PLC. This is similar to the approach used by the UPCI. For more information on UPCI, refer to the "Universal Programmable Controller Interface User's Guide" (U0-1960).

The PLC.GROUP file resides in the $WDPF_HOME/dl/config directory and is specified by the **DL.PLC.x.PointGroupDefFile** parameter. (Refer to the "WEStation Data Link Server User's Guide," (U0-8700), for more information on standard point group parameters.) Each point group produces or processes a single message to a Reliance processor.

Table 3-2defines the parameters in a PLC.GROUP file.

Table 3-2. PLC.GROUP File Fields

Field	Description	Valid Option
name	Group name	16-character string
number	Group number	Integer
address	Node address of processor	Integer
operation	Message type	IN, OUT, OUT_E, or UNSOLICITED
interval	Interval time in seconds	Integer
auxiliary	Slot number	Integer
originated	Originated process points	True or false

Refer to the "Reliance AutoMate Communication Manual" (J3091PB) for message structures.

The process point information for each group is listed after the group header information. Each point name is followed by a comma, then a Reliance register number.These numbers may be entered in decimal, hex, or octal (i.e., 123, 0X7B, 173). Analog values require an entire register. A single bit from a register is mapped to a digital point by following the register number with a period and then the bit number. Note that the bit number **must** be defined in the same base as the register number (that is, use decimal, hex, or octal for both register and bit).

Each point must be mapped to a register. The register numbers do not have to be in any particular order and they do not have to be consecutive.The maximum number of registers allowed in a read or write request is 122. Therefore, the difference between the highest and lowest register number in a group must be less than or equal to 122. An error will be generated if this is violated. This limit does not apply to UNSOLICITED point groups.

An example of a PLC.GROUP file is illustrated in Figure 3-2. Comment lines are indicated by (;) and (#).

3-4.1. Conversions

The PLC.GROUP file allows a conversion to be performed on a value before it is written to an analog point, or before a value from an analog point is written to a register. No conversion is performed if no conversion parameters are present.

The optional conversion parameters are located in the file after the register number. The first parameter is the conversion type. The type definitions are the same as for the CV field of an analog point. Refer to " Record Types User's Guide" (U0-0131) or to the "WEStation Data Link Server User's Guide" (U0-8700) for more information about conversion types.

The following parameters define the conversion variables such as gain and offset. For example, if a point name was listed in the PLC.GROUP file as:

A100, 03061, 1, 21, 33.3

then the conversion between register 03061 and point A100 is:

$y = 21 * x + 33.3$

The conversion type is 1 (linear), the gain is 21, and the offset is 33.3.

```
#####################################################################
/FILE:              title="PLC.GROUP"
# Point Group definition file for Reliance data link.
# Each point group produces one request to the Reliance PLC.
# The address range of the request is determined from the highest
# and lowest register address in the group.  The addresses do not
# have to be in order.  The range of the register addresses cannot
# exceed 122 since this is the limit for Reliance requests.
#####################################################################
#####################################################################
# read PLC register data and write to WDPF process point
# This is the 1st point group, its index is 0
/GROUP:             name = "input example", # group name
                    number = 5,     # group number
                    address = 4,    # node address of processor
                    operation = IN, # read reliance registers
                    interval = 2,   # interval time in seconds
                    auxiliary = 7,  # slot number
                    originated = true
# all points are originated
# The register addresses are shown in octal.  The bit number in
# a register address is also in octal.
# pointname, register, conversion type, gain, offset
DLX0010A, 03000.00    # COMPRESSOR STATUS
DLX0020C, 03000.017   # SWITCH 1 POSITION
ACX0230B, 03105, 1, 0.060, -10.8  # LV X AMPS
DIX9393A, 03014.05   # SWITCHER 1 TRIP
DL0B191C, 03050.011  # WINDING TEMP QUALITY
ALV9933C, 03106, 1, 3.34, 0  # XFMR HI SIDE Z AMPS
#############################################################
# Write WDPF point data to PLC registers
# This is the second point group, its index is 1
/GROUP:             name = "write example",
                    number = 2,      # point group number
                    address = 6,     # node address of processor
                    operation = OUT, # write reliance registers
                    interval = 10,   # interval time in seconds
                    auxiliary = 3,   # slot number
                    originated = false
# pointname, register, conversion type, gain, offset
DI0R451A, 03100.00   # COMPRESSOR A STATUS
DI0T453C, 03100.014  # DESICCANT DRYER A TROUBLE
DI0Y191C, 03150.00   # LV X WINDING TEMP QUAL
DI0P191D, 03150.01   # LV Y WINDING TEMP QUAL
DI0E191B, 03150.04   # HV WINDING TEMP QUAL
AI0C031B, 03105, 1, 100.0, 0  # XFMR1 HI SIDE Y AMPS
AI0L031C, 03106, 1, -3.3, 10  # XFMR1 HI SIDE Z AMPS
AI0S031A, 03107, 1, 0.025, -7.30  # XFMR TEMPERATURE
#############################################################
```

Figure 3-2. Example of PLC.GROUP File

```
############################################################

# Write WDPF point data to PLC registers
# The write request is sent for the entire group when the value
# of any point changes.

/GROUP:             name = "exception",
                    number = 6,     # point group number
                    address = 5,    # node address of processor
                    operation = OUT_E, # write by exception
                    interval = 5,   # polling time in seconds
                    auxiliary = 1,  # slot number
                    originated = false

# pointname, register, conversion type, gain, offset

DM0B751A, 03200.00   # COMPRESSOR C STATUS
DM0B413C, 03200.07   # DESICCANT DRYER C TROUBLE
DM0B041A, 03214.013  # KK CKT SWITCHER 1 TRIP
DM0B191C, 03250.00   # DF X WINDING TEMP QUAL
DM0B491D, 03250.06   # DF Y WINDING TEMP QUAL
DM0B151B, 03250.017  # PL WINDING TEMP QUAL
AM0B031B, 03205, 1, 23.060, 0  # XFMR2 HI SIDE Y AMPS
AM0B031C, 03206, 1, 49.060, 30 # XFMR2 HI SIDE Z AMPS

############################################################

# map PLC registers to WDPF process points
# This is used when an unsolicited write request is received
# from the specified Reliance processor.

/GROUP:             name = "unsolicited",
                    number = 9      # point group number
                    address = 2,    # node address of processor
                    operation = UNSOLICITED, # read reliance registers
                    auxiliary = 1,  # slot number
                    originated = true

# pointname, register, conversion type, gain, offset

DC0B861A, 03030.00   # DP COMPRESSOR E STATUS
DC0B833A, 03030.01   # OD DESICCANT DRYER E TROUBLE
DC0B491A, 03036.00   # DC X WINDING TEMP QUAL
DC0B951B, 03036.015  # DF Y WINDING TEMP QUAL
DC0B991C, 03036.02   # GJ WINDING TEMP QUAL
AC0W231B, 03135, 1, 3.460, 1000  # XFMR4 HI SIDE Y AMPS
AC0W621C, 03136      # XFMR4 HI SIDE Z AMPS
AC0W221A, 03137      # XFMR4 TEMPERATURE

############################################################
```

Figure 3-2. Example of PLC.GROUP File (Con't.)

3-5. Executable File

The binary executable file **dl_reliance** resides in directory $WDPF_HOME/dl/bin.

Multiple instances of the Reliance executable file can run simultaneously on a single DLS. This allows the WEStation to communicate with more than one Reliance gateway at a time, which speeds up communication when dealing with a large number of process points and/or Reliance PLCs. A group of parameters in the CONFIG.DL file is matched with its corresponding executable file through the use of a command line argument. For example, the executable should be started up as **dl_reliance -l 2** to use the parameters that begin with DL.PLC.2.

3-5.1. Command Line Arguments

Table 3-3 describes the command line arguments necessary to enable status messages.

Table 3-3. Command Line Arguments

Argument	Description	Function
-o filename	Output device	Prints log messages to screen or file. For example: **-o stderr** prints log messages to the screen; **-o log.dat** prints messages to the log.dat file
-l subsystem number	Subsystem number	Identifies the subsystem. For example, -l 2 starts the second instance of the subsystem
-t display	HEX display	Displays the messages in HEX on the specified output device
-t menu	Menu test	Prints a menu to the screen for testing and debugging purposes
-syslog n	Test message priority	Changes priority of test messages where n is a number from 3 to 7. Three is error priority; seven is debug priority.

Section 4. Interface Functions

4-1. Section Overview

This section discusses the communication protocol and the functional operation of the Reliance Interface. It is divided into the following sections:

- Communication Protocol (Section 4-2)
- Interface Operations (Data Exchange Functions) (Section 4-3)

4-2. Communication Protocol

The Reliance Interface supports RS-232 communication with Reliance PLCs. When a message is sent to the PLC, an acknowledge (ACK) message is returned, followed by the response message. The response is then acknowledged by the interface. If the interface does not acknowledge the response, then the PLC resends the message a configurable number of times.

The **DL.PLC.x.ACKTimeout** parameter defines the ACK time-out in milliseconds. The **DL.PLC.x.MessageTimeout** parameter defines the time (in milliseconds) that the interface will wait for a response before sending a retry. The **DL.PLC.x.NumberRetries** parameter defines the number of retries. A communication failure is declared after an unsuccessful attempt to send a message. A communication fault is declared after the **DL.PLC.x.MaxCommErrors** number of failures. A communication fault causes the interface to attempt to communicate with the auxiliary gateway if configured accordingly. The **DL.PLC.x.Redundant** parameter indicates that the interface is in a process redundancy configuration. The Redundant flag causes the interface to terminate if it cannot re-establish communication. For more detail about these CONFIG.DL file parameters, see Section 3-3.

4-3. Interface Operations (Data Exchange Functions)

4-3.1. Output WDPF Process Point Data to PLC (OUT)

The OUT statement in the PLC.GROUP file causes the Reliance Interface process to read data from the specified WDPF process points and writes this data to the specified PLC registers. This is done at a configurable time interval. This operation causes a write register (04) message to be constructed. The address in the message is determined by the lowest register number in the group. The length of the message is determined by the highest and lowest register numbers in the list. Each register value is 2 bytes long. Undefined registers are set to zero. The maximum address range is 122 registers.

4-3.2. Input PLC Data to WDPF Process Points (IN)

The IN statement in the PLC.GROUP file causes the interface process to read data from the specified PLC address and write to the specified WDPF process points. This is done at a configurable interval. The WDPF process points must be originated by the DLS drop. The WDPF process point statuses are set to Bad quality if the interface cannot communicate with the PLC. The statuses are set to Good quality when data is written. This operation causes a read register (03) message to be constructed. The address of the message is determined by the lowest register number in the group. The byte count field in the message is determined by the highest and lowest register number in the list. The byte count is (high register - low register + 1) * 2. The maximum address range is 122 registers.

4-3.3. Output WDPF Process Point Data to PLC by Exception (OUT_E)

The OUT_E statement in the PLC.GROUP file causes the interface process to read data from the specified WDPF process points and write to the specified PLC address when a change is detected in a value. The PLC is written to at startup and then whenever a change is detected. All values from the WDPF point group are written when a change is detected in one or more points from the group. A write register (04) type message is used. The maximum address range is 122 registers.

4-3.4. Input PLC Data to Process Point Data by Exception (UNSOLICITED)

The UNSOLICITED statement in the PLC.GROUP file causes the interface process to accept unsolicited write register (04) messages from the PLC. The data is written to the specified WDPF process points. The PLC can be configured to return data from the specified PLC address when it detects a change in the value. The WDPF process point statuses are set to Bad quality until they are written with valid PLC data. The received 2-byte register values are mapped to points defined in an UNSOLICITED point group. The Address field of the point group must match the source address of the request from the PLC. There is no limit to the number of registers in this group.

4-3.5. Accept GPM Command to Output to PLC Register

The Reliance Interface receives GPM requests from the WEStation to set or reset a bit in a specified register in a PLC. A graphics application program (#96) on the WEStation uses the CONTROL_PC statement to generate this request. The syntax of the CONTROL_PC statement is found in Appendix A.

The Reliance Interface accepts unsolicited GPMs of type 63. It uses this information to construct a write point (02) command. The structure of the user data for this type of GPM is:

```
typedef struct gpmcontrolmsg{

unsigned short src_drop;        /* drop number of sender */
unsigned short gpm_msg_type;    /* GPM type */
unsigned char msg_type;         /* unsolicited message type */
unsigned char port;             /* unused for WEStations */
unsigned short cmd;             /* unused */
unsigned short slot_reg;        /* 0-11 = reg num, 12-15 = slot */
unsigned short value;           /* 1 or 0 */
unsigned short node_bit;        /* 0-7 = bit num, 8-15 - dst addr *

} GPMControlMsg;
```

4-3.6. Accept GPM Command for Processor Status

The Reliance Interface receives GPM requests from a graphics program for the status of a specified PLC. The interface gathers the status from the processor and returns a block GPM to the graphics program. See Appendix A.

Section 5. Startup and Interface Operations

5-1. Section Overview

This section discusses the Reliance Interface startup and status operations. It is divided into the following sections:

- Startup (Section 5-2)
- Reliance Interface Status (Section 5-3)
- Shutdown (Section 5-4)

5-2. Startup

The Reliance Interface is started when the WEStation is booted. It can also be restarted by using the Query/Download function at an Operator WEStation. Refer to "Engineering WEStation User's Guide" (U0-8200) for more information on the Query/Download function.

The **startup.dl** file in the $WDPF_HOME/dl/init directory is configured to start the Reliance Interface.

The $WDPF_HOME and $WDPF_PDIR environments variable should be set before starting the software. (These are mentioned here for verification purposes only. No new environment variables need to be set for this software.)

5-2.1. Initialization

The Reliance Interface software performs the following initialization tasks:

- Opens the Sun Highway Controller (SHC) memory to access process point data.
- Reads the CONFIG.DL configuration file.
- Initializes the error reporting mechanism.
- Reads the PLC.GROUP file.

5-2.2. Process Point Quality Upon Startup

Startup of the Reliance Interface software temporarily changes the quality of the process points to which the software is writing to Bad quality. As the software progresses through the commands and starts mapping data to process points, the quality of these points is restored to Good quality. This process provides confirmation that the interface software is functioning correctly and is receiving valid messages.

5-3. Reliance Interface Status

Diagnostic capabilities of the Reliance Interface software include the following:

- Functions of the 32-bit link status point.
- Configuration parameters that enable error and status messages to be sent to the screen or to a specified output file.
- Drop fault report that identifies an error.

5-3.1. Link Status Point

The status of the Reliance Interface is determined by the value of a packed digital (PB) point which is broadcast on the WDPF highway. This point is an originated point on the WEStation and must be specified in the CONFIG.DL file in the **DL.PLC.x.LinkStatusPoint** parameter. If no point is specified in the CONFIG.DL file, then this feature is disabled, an informational message is logged during interface startup, and no status is reported.

The link status point has a 32-bit value. The current message count, last reported error code, and subsystem status are mapped to this point. Description of each applicable bit is provided below.

- Bits 0 - 7 indicate the link status.

  0 = Shutdown
  1 = Alive
  2 = Enabled
  4 = Connected
  8 = Backup

- Bits 8 - 15 indicate the error codes.

  109 = SHC initialization error
  201 = Device initialization error
  212 = Received invalid message
  213 = Invalid message length
  215 = Error in reading the message
  223 = Invalid message type

- Bits 16 - 19 are not applicable.
- Bits 20 - 32 indicate the message count.

5-3.2. CONFIG.DL File Status Indicators

Last Communication Point

The last communication point (**DL.PLC.x.LastCommPoint**) is an analog point that contains the timestamp of the last transmitted message. The timestamp is the number of seconds since the beginning of the year. This point can be used as an activity indicator. The interface is inactive if this point does not change value. This point is set to zero at startup.

Digital Alarm Points

The digital alarm points (**DL.PLC.x.Digital Alarm Point0**, **DL.PLC.1.Digital Alarm Point1**) indicate the status of the main and auxiliary devices. The digital point is set to 1 if the port is able to communicate. In a redundant gateway configuration, the backup gateway is polled at one-minute intervals to determine if it is able to communicate.

Error Count Point

The error count point (**DL.PLC.x.Error Count Point0**) is incremented whenever a communication error is observed. Communication errors include: circular redundancy check (CRC) errors, message time-outs, and ACK time-outs. The interface never clears this point. It can be cleared by the user to determine the frequency of errors.

5-3.3. Error Reporting

The software uses the syslog error logging facility under UNIX®. Error and status messages are sent to the syslog and are reflected on the General Message Display of the Operator Station (since the DLS drop normally does not have a monitor).

For diagnostic purposes, the **dl_reliance** routine (described in Section 3-5) can be started from a shell tool. A configuration parameter (see Section 5-3.2) is used to indicate errors by displaying status messages to a specified output file. This feature is used for debugging and is not normally enabled.

Command line arguments are used to enable status messages. For example, the **-o stderr** command line argument causes status messages to be written to the shell tool. The **-syslog n** command line argument is used to control the severity of the status. Refer to Section 3-5.1 for more information on command line arguments.

The messages displayed depend upon the warning level (priority code) specified by the **DL.PLC.x.SyslogPriority** parameter, either in the CONFIG.DL file or on the command line. If the priority code is set to 3, then all messages above and including level 3 are displayed. For the Reliance Interface, the priority code number can range from 3 to 7; 3 is for error messages and 7 is for debug messages. The various warning levels are listed in Table 5-1.

Table 5-1. Priority Levels for Error Logging

Message	Priority Codes	Condition
LOG_EMERG	0	System is unusable
LOG_ALERT	1	Action must be taken immediately
LOG_CRIT	2	Critical conditions
LOG_ERR	3	Error conditions
LOG_WARNING	4	Warning conditions
LOG_NOTICE	5	Normal but significant conditions
LOG_INFO	6	Informational messages
LOG_DEBUG	7	Debug Level messages

5-3.4. Drop Fault

Although the software is designed to operate indefinitely, it may encounter a problem from which it cannot recover. If the subsystem detects an unrecoverable error, it declares a drop fault and aborts. (An example of an unrecoverable error is a missing PLC.GROUP file.) A drop fault does not affect the other subsystems on the drop.

The drop fault description is shown on the Drop Details Diagram of the system status display. Refer to "Self-Test Diagnostics" (M0-0003) for more information on drop faults.

The drop fault report consists of the current drop Fault Code, Fault ID, and Fault Parameters 1 and 2. The Fault ID identifies the subsystem (Reliance Interface) and the Fault Parameters identify the failure (SHC error, missing configuration file, communication device failure). The Fault Code for data links is **190**, and the Fault ID for the Reliance Interface is **18**.

Fault Parameter 1 identifies the device that failed. Fault Parameter 2 is the error code of the device that failed. The possible fault codes are listed in Table 5-2.

Table 5-2. Drop Fault Parameters

Fault Parameter 1	Fault Parameter 2	Description
1	0	Missing configuration file
2	0	Serial port error
3	errno.h	System call error
4	spd.h	System point directory error
6	shc_err.h	SHC error
14	0	Unscheduled exit
Note: Fault Code = 190; Fault ID = 18.		

5-4. Shutdown

The system can be shut down using the Data Link Server Manager.

Upon shutdown, the Reliance Interface will set all the originated points from the PLC.GROUP file to Bad quality and then declare a drop fault.

Appendix A. Sample Graphics Problem-Oriented Language (POL) Program

A-1. General Information

This appendix describes a sample program in the Graphics Problem-Oriented Language (POL) which illustrates use of the CONTROL_PC and POKE_FLD statements. This program is intended only as an example of the kinds of control that may be utilized for specific applications.

CONTROL_PC and POKE_FLD statements may be used in the Graphics POL to set or reset a bit in any PLC using the control keys of the Operator Station. The syntax for these two statements is presented below, followed by the sample program utilizing them. The CONTROL_PC command must be used.

This program defines a diagram which will set a bit in subdrop 0, 7, or 8 of drop 130. The diagram is set up to transmit one of 48 different messages to the PLC: 24 to set a bit and 24 to reset a bit. One of the 24 boxes will turn red to indicate the selected message pair after the user does one of the following:

- Tabs to a poke field and depresses “Select”
- Depresses one of the control keys (1 through 8)

The other 23 boxes will remain blue. The user may then send a set message if the “On” key is depressed or a reset message if the “Off” key is depressed. The diagram is illustrated in Figure A-1.

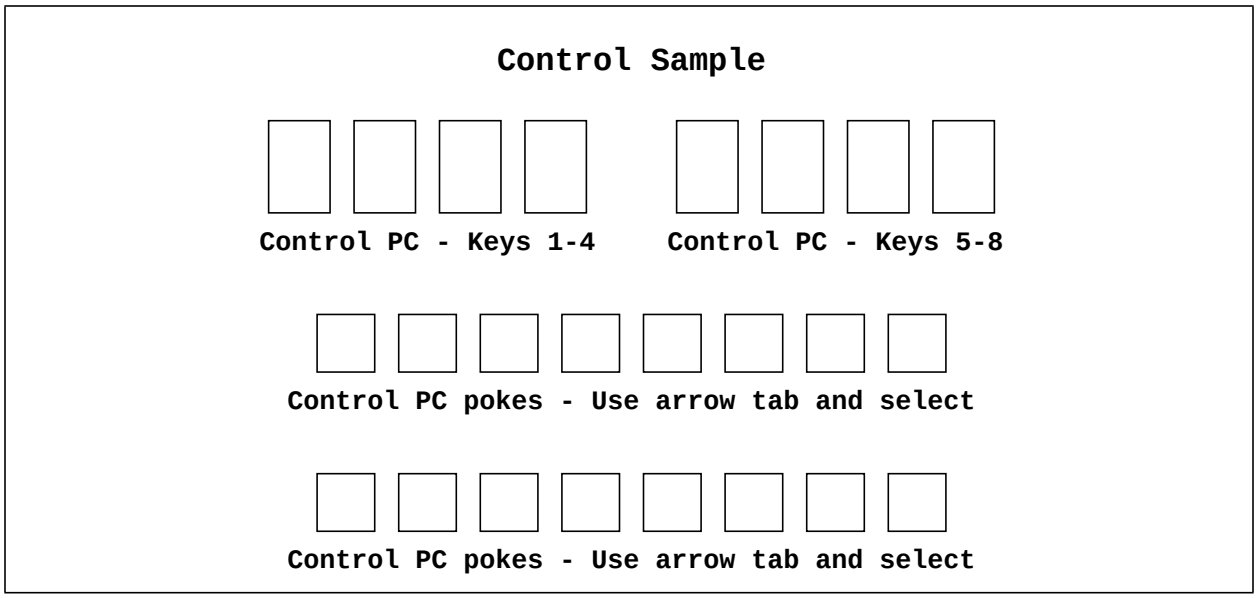

Figure A-1. Sample Diagram Using CONTROL_PC and POKE_FLD

A-2. Statement Syntax

A-2.1. CONTROL_PC

The syntax of the CONTROL_PC statement is shown below.

CONTROL_PC control_key drop port/subdrop register bit

where

control_key = Integer between 1 and 8 specifying which **control** key is to be used. Note that this is control key 1 to 8 not key 1 to 8

drop = WEStation drop number

port/subdrop = Integer between 0 and 8, specifying the number of the port connected to the PLC or network

register = Bits 0 to 11 = register number 1 - 7777 (octal), depends on PLC.
Bits 12 to 15 = slot number (0 - 15).
For example: 12289 = 3001H, where 001 is the register number and 3 is the slot number.

bit = High byte = node number (0 - 31).
Low byte = bit of register that is used to set START/STOP (0 - 15).
For example: 2052 = 804H, where 04 is the bit of the register and 8 is the node number.

A-2.2. POKE_FLD

The syntax of the POKE_FLD statement (as it applies to controlling a PLC) is as follows:

POKE_FLD x_coord y_coord width height ‘7’ ‘1’ ‘96’ ‘0’, ‘7’
drop port/subdrop register bit ‘1’ set# ‘2’

where

x_coord	=	Beginning X coordinate
y_coord	=	Beginning Y coordinate
width	=	Width of poke field
height	=	Height of poke field
‘7’	=	Poke type (programs/options)
‘1’	=	Program list
‘96’	=	CONTROL_PC POKE program number
‘0’	=	Diagram number
‘7’	=	7 Arguments
drop	=	WES drop number
port/subdrop	=	Integer between 0 and 8 specifying the number of the port
register	=	Refer to CONTROL_PC statement
bit	=	Refer to CONTROL_PC statement
‘1’	=	Trigger number Note that 1 should always be used to clear any other Trigger action
set#	=	Set number
‘2’	=	Set value (1 will be reset (unselected) value)

A-3. Sample Program

The following is an example of a POL program using the CONTROL_PC statement An asterisk (*) indicates a comment line.

```
TITLE  'control pc'
DIAGRAM 2600  0  MAIN
*
BACKGROUND
COLOR  FG  CYAN
TEXT 30     1  'Control Sample'
TEXT   7     7  'Control PC - keys 1-4'
TEXT 47     7  'Control PC - keys 5-8'
TEXT   7   13  'Control PC pokes - use arrow tab and select'
TEST   7   19  'Control PC pokes - use arrow tab and select'

TRIG_ON 1

TRIGGER 1

COLOR  FG  BLUE  (SET1)      RED
LINE        26     24    50       24     50    44     26   44    26    24
COLOR  FG  BLUE  (SET2)      RED
LINE        74     24    98       24     98    44     74   44    74    24
COLOR  FG  BLUE  (SET3)      RED
LINE       122     24   146       24    146    44    122   44   122    24
COLOR  FG  BLUE  (SET3)      RED
LINE       170     24   194       24    194    44    170   44   170    24
COLOR  FG  BLUE  (SET5)      RED
LINE       266     24   290       24    290    44    266   44   266    24
COLOR  FG  BLUE  (SET6)      RED
LINE       314     24   338       24    338    44    314   44   314    24
COLOR  FG  BLUE  (SET7)      RED
LINE       362     24   386       24    386    44    362   44   362    24
COLOR  FG  BLUE  (SET8)      RED
LINE       410     24   434       24    434    44    410   44   410    24

COLOR  FG  BLUE  (SET9)      RED
LINE        26     84    50       84     50   104     26  104    26    84
COLOR  FG  BLUE  (SET10)     RED
LINE        74     84    98       84     98   104     74  104    74    84
COLOR  FG  BLUE  (SET11)     RED
LINE       122     84   146       84    146   104    122  104   122    84
COLOR  FG  BLUE  (SET12)     RED
LINE       170     84   194       84    194   104    170  104   170    84
COLOR  FG  BLUE  (SET13)     RED
LINE       218     84   242       84    242   104    218  104   218    84
COLOR  FG  BLUE  (SET14)     RED
LINE       266     84   290       84    290   104    266  104   266    84
COLOR  FG  BLUE  (SET15)     RED
LINE       314     84   338       84    338   104    314  104   314    84
```

```
COLOR FG BLUE (SET16)     RED
LINE      362   84  386       84  386  104  362  104  362   84


COLOR FG BLUE (SET17)     RED
LINE       26  144   50      144   50  164   26  164   26  144
COLOR FG BLUE (SET18)     RED
LINE       74  144   98      144   98  164   74  164   74  144
COLOR FG BLUE (SET19)     RED
LINE      122  144  146      144  146  164  122  164  122  144
COLOR FG BLUE (SET20)     RED
LINE      170  144  194      144  194  164  170  164  170  144
COLOR FG BLUE (SET21)     RED
LINE      218  144  242      144  242  164  218  164  218  144
COLOR FG BLUE (SET22)     RED
LINE      266  144  290      144  290  164  266  164  266  144
COLOR FG BLUE (SET23)     RED
LINE      314  144  338      144  338  164  314  604  314  144
COLOR FG BLUE (SET24)     RED
LINE      362  144  386      144  386  164  362  164  362  144

KEYBOARD
*
*RELIANCE PLCs
```

Dec	(Octal)		Dec	(Octal)		Dec	(Octal)	Dec	(Octal)
* These statements will be set									
bit 0	(0)	in register	0	(0)	in node	0	(0)	slot 0	(0)
bit 6	(6)	in register	50	(62)	in node	6	(6)	slot 15	(17)
bit 10	(12)	in register	2000	(3720)	in node	20	(24)	slot 2	(2)
bit 8	(10)	in register	256	(400)	in node	31	(37)	slot 0	(0)
bit 12	(14)	in register	23	(27)	in node	2	(2)	slot 5	(5)
bit 3	(3)	in register	1234	(2322)	in node	16	(20)	slot 0	(0)
bit 9	(11)	in register	128	(200)	in node	10	(12)	slot 7	(7)
bit 4	(4)	in register	1	(1)	in node	8	(10)	slot 3	(3)

* Octal numbers used in PLC. Decimal numbers required in diagram.

*

*	KEY	DROP	SDROP	SLOT/REG	NODE/BIT
CONTROL_PC	1	130	7	0	0
CONTROL_PC	2	130	7	-4046	1542
CONTROL_PC	3	130	7	10192	5130
CONTROL_PC	4	130	7	256	7944
CONTROL_PC	5	130	7	20503	524
CONTROL_PC	6	130	7	1234	4099
CONTROL_PC	7	130	7	28800	2569
CONTROL_PC	8	130	7	12289	2052