NOTICE

In addition to this booklet, Control Chief offers supplementary product and/or application information assistance if requested. However, we can accept no responsibility for the improper application of the remote control system. Further, Control Chief recommends all appropriate safety and operating manuals relating to the controlled device or machine be reviewed prior to the installation of the remote control system. All applicable safety codes and standards must be reviewed and followed.

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COMMUNICATOR™ is a trademark of Control Chief.

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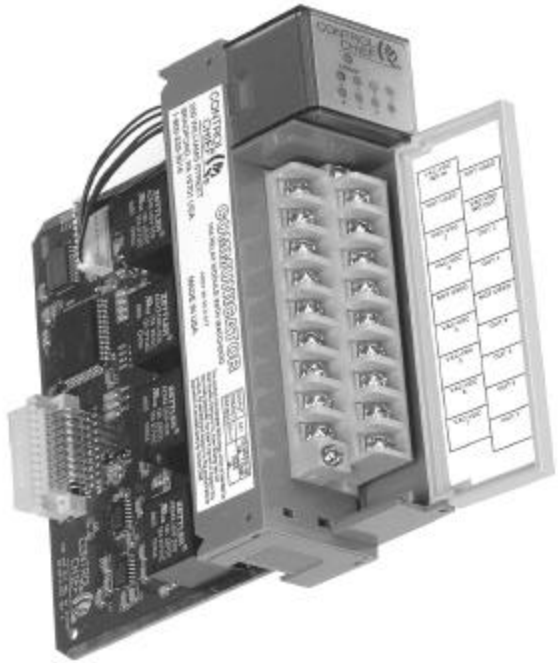
95-00-0-019 Rev. A

CONTROL CHIEF®

High Current Relay / Watchdog Module

With feedback capabilities



User's Guide

ROCKWELL AUTOMATION ENCOMPASS AMERICAS PARTNER

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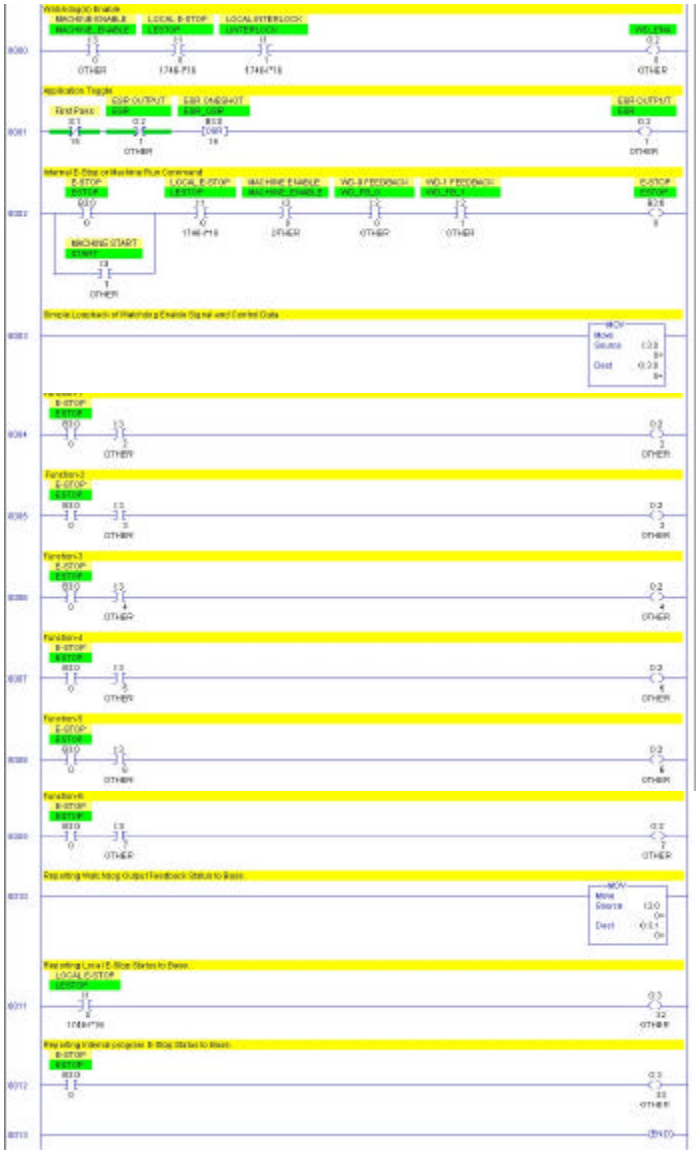
Ladder Programming Example



The next rung provides the primary control status used throughout the program to enable all critical functions, such as, motion commands.

If either Watchdog were to time out, its associated relay would de-energize opening the MLC control circuit. In order for the system to come back online the enable signal must be removed to de-energize both watchdog circuits. Then the enable signal can be applied to allow a re-start of the system. This is particularly essential for Safety Relays, which require both outputs to be off before the Safety Relay can be re-energized. The status of the Watchdog circuits can be monitored by their associated feedback signals in the module input word.

Loopback (Rung 0003)
Simple Loopback of Watchdog Enable Signal and Control Data

Control Data (Rung 0004 through Rung 0009)

The remaining 6 outputs, 2 through 7, of the Watchdog Module can be utilized for general purpose relay outputs.

The following rungs 0004 through 0008, provide an example of using the E-Stop bit to enable machine output commands, represented by Functions 1 through 6.

Note, each rung is qualified with the E-Stop bit (B3:0/0). If the E-Stop becomes disengaged due to a local or remote E-Stop, or a Watchdog Fault, all outputs will be commanded off.

Watchdog Outputs and Control Output Status Reporting to Base (Rung 0010 through Rung 0012)

The Watchdog output control status is being sent back to the Base by Rung 0010. This status information can be used at the Base Unit for monitoring and alarm actions.

Local Control Status report is setup by Rungs 0011 and 0012.

This example shows the advantage the Communicator™ Model 2400 provides for SLC 500 Wireless Remote Control Applications - the ability to control, the capability to monitor - to KNOW what the machine is doing - the issuance to verify its operational command response.

End (Rung 0013)

Overview

The High Current Relay/Watchdog Module was designed to be used in conjunction with one of Control Chief's Communicator™ Modules. The combination of these modules allows the user to convert any Allen-Bradley SLC-500 into a radio remote control. Control Chief offers several hand held transmitters to achieve communications from an operator to the SLC-500.

Remote Control systems based on the SLC-500 controller with a Communicator™ Wireless Module will utilize a multiple watchdog safety system. The first watchdog circuit is built into the wireless Communicator™ Module. This watchdog monitors the operation of the CPU module and it's embedded firmware. Should this watchdog timer time out, then an automatic interrupt is generated which faults the SLC-500 CPU and clears all SLC input tables. An additional watchdog within the module will clear the module input image table if communication with the remote unit is lost.

The High Current Relay/Watchdog Module incorporates 2 additional watchdog safety systems. Each Watchdog safety system consists of a watchdog circuit that drives a dedicated output relay. Each watchdog circuit monitors a critical system function (slot select pulse and application ladder toggle) to verify proper system operation. The dedicated Watchdog Relay outputs are used to control the Main-line Contactor (MLC) or Main Line Control Relay (MCR). The module is available in two Watchdog Relay Output configurations: Series or Parallel. The configuration implemented depends on the type of MLC or MCR used in your application and applicable safety codes and standards.

Backplane current requirements are 70mA per active relay for a maximum of 650mA. All relay contacts are electrically isolated and each contact available is normally open.

By incorporating the Communicator™ Module and the Watchdog module the desired level of safety is achieved in the SLC-500 platform. These modules provide experienced SLC 500 programmers a new solution for a wide variety of applications.

Module Operation

Watchdog Operation

The Watchdog module contains two built in watchdog circuits with dedicated relay outputs. One watchdog circuit checks the operation of the SLC-500 CPU by monitoring the slot select pulse from the CPU as the rack slots are scanned. The second watchdog monitors an application-generated pulse derived from the ladder logic program. Both watchdog circuits are enabled via output bit 0 (O:x.0/0), which is referred to as the Enable Command.. Additionally, the enable command provides direct control of the watchdog relay outputs ("0" and "1").

The watchdog monitoring functions are engaged once the watchdogs are enabled. The first watchdog obtains its refresh signal from the Slot Select Pulse via the SLC backplane. This is to verify the operation of the SLC processor. The second watchdog requires a refresh signal from the application ladder program. This ensures the ladder program is not hanging up on a subroutine or some other unexpected programming function. The application refresh is based on the processor scan time. Maximum refresh time for the application toggle is 550mSec. If either watchdog does not receive a timely refresh pulse it will time out, which will turn off its associated relay output and disengage (O:x.0/1). The application program will then force both outputs off before either can be re-activated. (This is typically done with the Enable Command.)

**** Machine Control Programming Example ****
4/20/2000
Control Chief 1746 Components used in this example:
High Current Relay with Watchdog
Communicator ™ Model 2400 (Remote Configuration)

See text for Watchdog Module Installation and Operating details.

E-Stop and Interlock Switches:
In their normal operating mode the switches are Normally Closed. This facilitates a failsafe mechanism by insuring the switch is closed, which is the operating position.

In this programming example an Input Module is installed in Slot 1, the Watchdog Relay Module is installed in slot 2, and the Communicator™ Module is installed in Slot 3.

!!!! NOTICE !!!!
Due to the many requirements associated with any particular application and installation, Control Chief Corp. cannot assume responsibility or liability for actual use based upon this example.

The Watchdog control and refresh functions are performed in the first two rungs, 0000 and 0001.

Watchdog Enable (Rung 0000)

Output 0, is the Enable signal for Both watchdog circuits. As shown on Rung 0000, this output is engaged when all applicable system interlocks are satisfied and the "MACHINE_ENABLE" command is received from the Base Unit.

Application Toggle (Rung 0001)

This Rung shows how the application ladder provides the refresh toggle for the second Watchdog.
The One Shot Relay function is used to insure the rung completes a toggle, which the watchdog requires to keep its timer from timing out. Without the OSR it is possible a fast processor scan would be so fast that the Watchdog timing circuits would not see the output toggle. In order for output 1 to be energized the Watchdog must be ENABLED and the associated watchdog refreshed.
E-Stop (Rung 0002)

Be advised that if the RF path becomes obstructed, to the extent that a dropout occurs, the input table will be cleared. Typically, a dropout is just momentary. The RF link re-establishes and the data is once again received and available at the input table. Therefore, the programmer must consider how this event, clearing of the input table due to a momentary dropout, affects the process being controlled.

Module Application:

The Watchdog Relay Module is placed in the rack of the controller doing the actual machine control along with the Communicator™ Model 2400 (configured as a remote).

The programmer utilizes BOTH modules, working in concert, to insure the safe operation of the machine being remotely controlled. Thus, achieving the only PLC platform in the industry capable of implementing a wireless Remote Control system.

Communication Definitions for Programming:

Typically, a control system will consist of a control station and a machine station. The Control Station initiates the commands to the machine station – the Control Link. The machine station receives the commands and acts on them according to a predefined process or recipe. The machine station performs the commanded control tasks and reports the status of the process back to the Control Station – the Status Link.

Communication Status Word:

In your application you may want to consider designating a "word" for communication status in the unused I/O. The concept of this Comm Status is to provide an internal flag or signal to the program that indicates three things. 1. The link is active and a process can begin. 2. The link has dropped take an action.
3. The link is active but the operator has commanded a shutdown. An example of this concept is presented on the following page.

Output Operation

The programming for the High Current Relay/Watchdog Module operates the same as a standard Allen-Bradley output relay module. Using the correct slot in which the module is installed, bits 0 through 7 correspond to the 8 relay contacts (0-7) on the module. These bits are modified through the user program as desired. As stated earlier, each contact is normally open and the corresponding bit must be set to logic one to energize the relay coil.

Watchdog Relay Output Configuration:

Two configurations of the module are available to accommodate your requirements for typical MLC control (series) or Safety Relay (parallel).

Series:

Relay 0 and Relay 1 are wired in series, internally. Relay 0 output is not available in this configuration. Typically, the source voltage for the Main Line Contactor is wired to relay 0 input (VAC-VDC, WD-IN). Correspondingly, Relay 1 should be used as the MLC control output.

Parallel:

In this configuration both outputs are available as control inputs to a Safety Relay.

Module Status Indicators:

An illuminated RED ERROR LED indicates a Watchdog fault. Refer to the Troubleshooting Table on page-9 for details. Each output point has an associated output LED status indicator. When the processor commands an output point ON, the associated LED will illuminate GREEN to indicate an ON status.

Input Operation (Feedback Functionality)

The feedback functionality of the High Current Relay/Watchdog Module is designed to give the programmer the ability to monitor the status of the relay coils within the module. These are 8 bits returned to the input image table for the corresponding slot that the module is placed in. A zero is returned to the processor when the relay is de-activated through the ladder program. A one is returned to the processor if the relay is activated through the ladder program, or if the relay is de-activated and the coil is open on the relay. In order to take advantage of this functionality, the status of the input file must be compared with the output file when in a de-energized state to insure relay integrity. The user must allow for relay response times when using the feedback feature, see specifications for response times.

Installation

ATTENTION: Never insert or remove the modules with power applied to the rack!

The Watchdog Module can reside in any slot in the SLC 500 chassis with the exception of the first slot (this slot is reserved for the processor or the ASB Module).

1. Remove and lock out power to the SLC chassis.
2. Align the printed circuit card edges with the guides in the SLC rack.
3. Slide the High Current Relay / Watchdog Module in until the tabs on top and bottom of the plastic card housing lock into the rack.
4. Wire the outputs in accordance with your local building codes, the NEC, and the wiring diagram on page 6 or 7o f this manual.
5. Cover all unused slots with Card Slot Filler, Catalog #1746-n2 (Available at your local Allen-Bradley Distributor).

I/O Configuration

1. Open I/O Configuration Table through RS Logix 500 Software. (Consult your Allen-Bradley distributor for assistance with this product).
2. Select “other” from the list of available modules on the right side of the screen.
3. Enter the number **1935** in the space provided as the module’s **ID code.**

SLC 500 Remote Control Implementation – Programming Recommendations:

For narrow band applications utilizing a Control Chief Transmitter, refer to the appropriate Communicator™ Model User Guide.

This discussion presented here is based on the Application of the Watchdog Relay Module with the Communicator™ Model 2400.

General Principles:

Advantages of the Communicator™ and Watchdog Relay Module combination for SLC 500 Remote Control:

- Each network is assigned an operating channel. Each remote is assigned a unique address within the network. The correct device receives its data – not some other device’s data.
- The data is reliable – what is sent is received. The module discards any data with an invalid parity check (or Address).
- Each received packet of data refreshes the control data. If data is not refreshed within a pre-defined period the entire input table is cleared.
- Deterministic data transfer resulting in real-time control capability.
- The two-way link allows a control station to also monitor the machine station, enabling the control station to verify operation and take appropriate action based on status received from the machine.
- The Watchdog Relay Module provides the capability for SLC 500 based applications to implement machine shutdown in an industry recognized method.

The RF link is not a perfect medium. Although the Communicator™ Module implements state-of-the-art reliable and robust radio communications, nonetheless, dropouts may occur. How frequent, depends on the environment in which the link is operating. In a reasonable environment the link should run indefinitely. What is or isn’t reasonable? A reasonable environment is one in which the RF path is defined and an appropriate antenna system is designed to provide reliable communications. An unreasonable environment is one in which it is constantly changing, particularly in the RF path. The most probable cause of dropouts would be attributed to obstacles in the propagation path of the RF signal. The Communicator™ Model 2400 operates in the 2400-MHz ISM Band, which is very line of sight sensitive – and is true of ANY device operating in this band.

Troubleshooting Table

LEDs					
Error	0	1	Error	Cause	Action
Off	Off	Off	Normal operation	Watchdog Enable command has not been sent	Send main on command
Off	On	On	Normal operation	Watchdog Enable is sent, watchdogs satisfied	Continue operation
On	Off	On	Slot select fault	Possible watchdog “0” fault. Slot select pulse is not functioning or possibly a problem on the module.	Replace watchdog module. If no change, contact factory.
On	On	Off	Application toggle fault.	Possible watchdog “1” fault. Application pulse is not functioning or possible problem with the module.	Replace watchdog module. If no change, contact factory.

Output Contact Rating:

AC ~	125VAC 10A	125VAC 1/4HP
DC ⎓	30VDC 5A	

Backplane current draw:

70mA per active relay

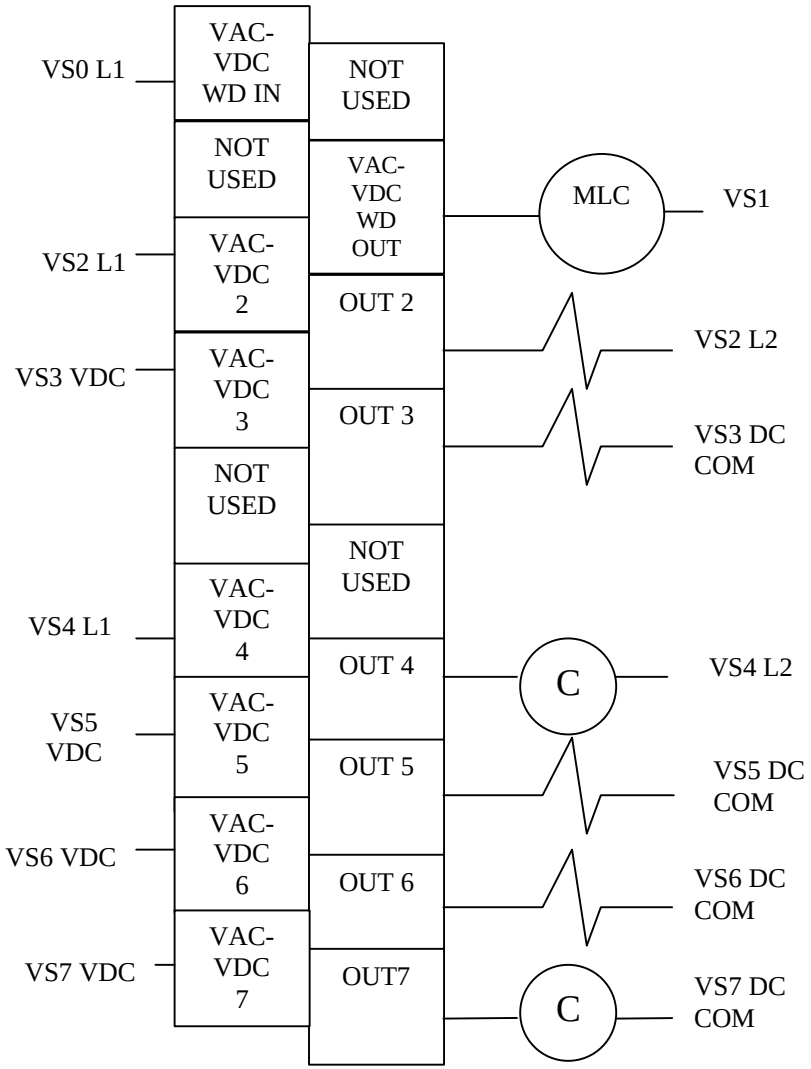
650mA maximum backplane current

Wiring Diagram

90-20-0-017

High Current Relay/Watchdog Module

WATCHDOG RELAYS IN SERIES

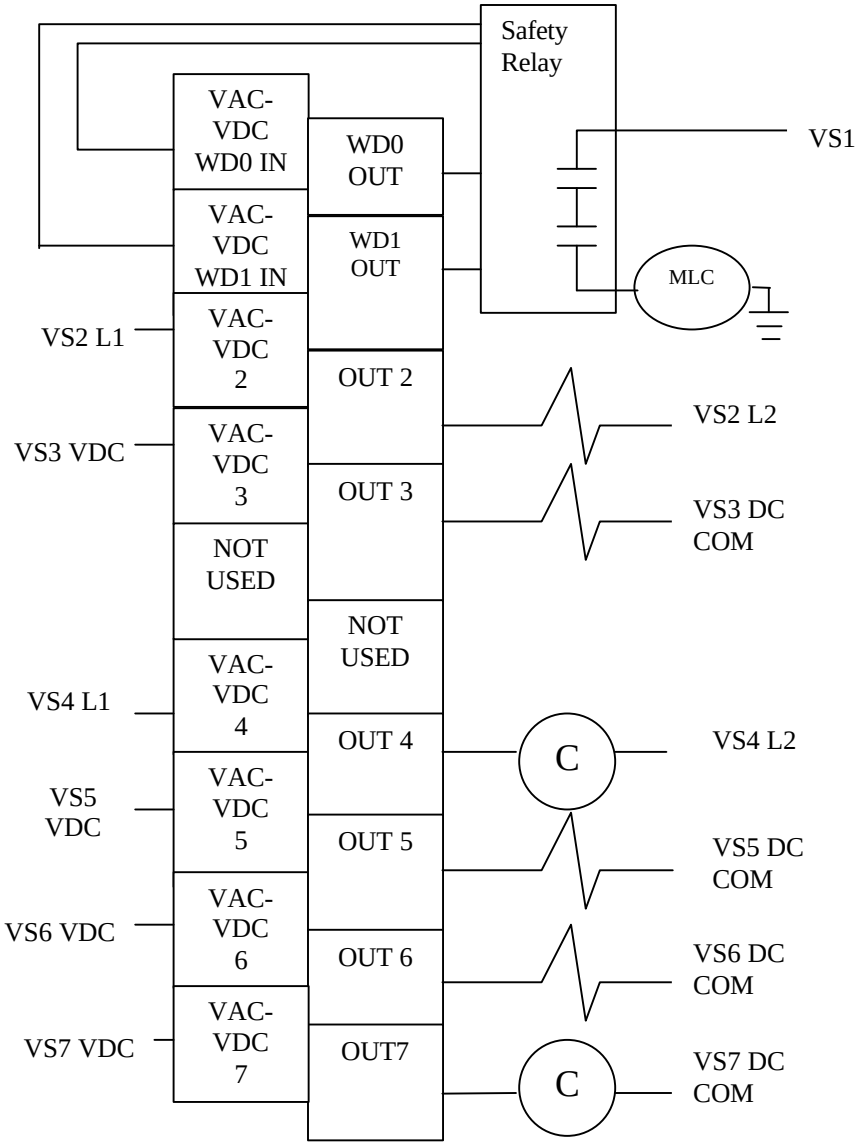


Wiring Diagram

90-20-0-018

High Current Relay/Watchdog Module

WATCHDOG RELAYS IN PARALLEL



Specifications:

Catalog Number	None, this module is not available through distribution. Contact Control Chief directly for spare parts.
Control Chief Part Number	90-20-0-017 Series 90-20-0-018 Parallel
Module ID Number	1935
Input File Size	1 Word
Output File Size	1 Word
Supply Voltage	+5vdc
+5vdc Supply Current	650mA
+24vdc Supply Current	0
Watchdog Minimum Refresh Period	<550mSec
Turn On Feedback Response	10mSec
Turn Off Feedback Response	4mSec