

Section 1 Operating Procedure

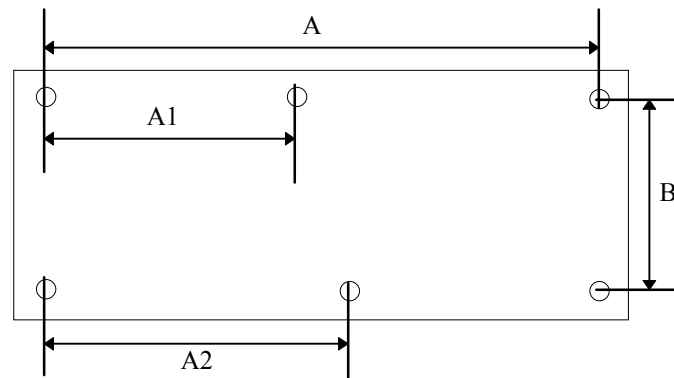
1. Introduction

The H-series PLC is a family of small, low cost, single-board Programmable Logic Controllers (PLCs). Presently, the series spans from the T20H with 12 inputs, 8 outputs to the T64H with 40 inputs and 24 outputs. Members of the H-series controller family differ mainly in the number of I/Os (inputs/outputs), and the type of I/Os they carry (relay or transistor outputs, PNP or NPN types, opto-isolator inputs or high voltage inputs, etc). Since each different PLC model has different wiring requirements, please refer to their respective Installation Guide on the wiring methods and installation details. The number of I/Os, timers, counters, internal relays as well as the maximum allowable program steps are also stated in the Installation Guide.

This manual is to be used with all the current and future H-series PLCs. Presently they include the T20H-npn, T28H-Relay, T44H-pnp, T44H-npn and the T64H-Relay. New models may be introduced as and when determined by market demand. The following table summarizes the number of I/Os, timers, counters and internal relays for each existing model:

No. of Model	Inputs	Outputs	Internal Relays	Timers	Counters	Maximum Program Steps
T20H-npn	12	8	128	20	20	400
T28H-Relay	16	12	128	20	20	400
T44H-npn/pnp	28	16	128	20	20	400
T64H-Relay	40	24	256	40	40	800

Position of Locating Pin for H-series PLCs



Model	A(mm)	B(mm)	A1(mm)	A2(mm)
T20H-npn	78.11	83.19	-	-
T44H-npn	139.7	106.68	-	-
T28H-Relay	159.39	87.00	-	-
T40H-Relay	186.06	93.98	83.82	83.82
T64H-Relay	182.25	113.67	-	-

2. Programming

The H-series controller is programmed using the software TRiLOGI Version 3.1 (or higher) which runs on an IBM compatible PC. This is a full-screen ladder logic editor, compiler and simulator software. TRiLOGI is a standalone software package which provides a powerful programming and debugging environment for ladder logic programming. Please refer to TRiLOGI's User Manual for details.

TRiLOGI is designed to program a larger number of I/Os, relays, timers and counters than are available on most of the models. Use no more than what are available on the controller (as described in the last section) for your programming purposes or else the program may not be transferred to the controller.

3. Simulation

A powerful feature unique to the TRiLOGI development environment is the built-in **simulator**. With the simulator, you can interact with your program by simulating the input conditions using only a keyboard and examine the status and present values of the outputs, relays, timers and counters on screen immediately. The simulator does not require any physical connection to the target PLC, and thus it offers the most effective way of testing and debugging your ladder logic program *prior* to installation of the hardware. No other low-cost PLC development environment to-date offers an on-screen simulator to ease the programming chore. Programming and debugging time can be greatly reduced if you make good use of the simulator feature to eliminate as many logic errors as possible before testing the program on the actual hardware. It also helps to reduce the chances of costly damage to the machine due to programming errors.

4. Downloading the Ladder Logic Program

Once you are satisfied with the TRiLOGI-simulated scenarios, return to the ladder logic editor by pressing the <ESC> key. To transfer the ladder program to the PLC, first connect the PC to either the RS232 or RS485 port of the PLC and turn on its power supply. You may either press <Ctrl-T> on the keyboard or open the "Controller" pull-down menu and select item "Program Transfer". TRiLOGI will query the target controller to obtain its

maximum number of inputs, outputs, etc. TRiLOGI will recompile the ladder program to ensure that these limits are not violated. When compilation is successful, the compiled code will be transferred to the H-series PLC in just a few seconds.

After the program has been successfully transferred, you will be prompted to indicate if you wish to clear all outputs, relays, timers and counters to "OFF". A successfully transferred program will be executed at once.

If errors occur during program downloading and the communication is aborted, the CPU will not execute the partially transmitted program to forestall undesirable consequences. If everything goes well, you may return to the editor by pressing any key.

If you encounter a "Communication Error" in the program transfer procedure, the following are some possible causes:

- 1) The PLC is not connected to the cable.
- 2) The host computer COM port is not connected to the cable.
- 3) Wrong COM port number is specified. Try another one.
- 4) Faulty serial port of host computer: test if the serial port is working using a mouse or a serial printer. Try with another PC if possible.
- 5) Faulty serial cable, try another one.
- 6) Power to PLC is not turned on or an inadequate power supply has been used. There was one case where a faulty switching power supply generated excessive electrical noise which disrupted proper communication between the PLC and the PC. This fault was not apparent as the power supply did give accurate voltage reading when its output was measured using a digital multi-meter. Try with another power supply if available.
- 7) Faulty communication hardware on the PLC - call your local dealer for assistance.

5. Errors and Problems

Any error in the source file detected during compilation will abort the program transfer process immediately. The cause of the first error will be reported on screen, although you should never encounter this problem if you did simulate the program successfully in TRiLOGI. This is because TRiLOGI's ease of programming reduces the possibility of errors to a minimum, and

any error would have been detected and rectified before any simulation can take place.

The EEPROM in the PLC allows a ladder logic program to contain up to a certain maximum number of steps. (Check the Installation Guide for the maximum number of program steps for your PLC model) Each contact and ordinary output coil takes 1 step, while the output coils of timers and counters occupy 2 steps each. Functions such as ANDLD, ORLD (these two instructions are implicit in the ladder diagram) ILock, IOff and MaCLR take only half a step.

If your ladder logic program used up more than the maximum available steps, the compiler will record this as an error and the downloading process will be aborted. If this happens, you need to simplify your program to optimize the use of program memory.

6. Monitoring PLC Operations

A. Capturing the I/O logic state

On the ladder logic editor screen or simulator screen of TRiLOGI, the current logic states and present values of the PLC's inputs, outputs, relays, timers and counters can be captured by simply pressing the function key <F8>. The captured I/O logic states and present values of timers and counters will be updated immediately on the screen. If a contact or a coil is active (logic '1'), its label name will be highlighted in the ladder diagram and this enables the programmers to easily identify the trouble-causing elements that affect the desired logic outcomes.

After capturing the actual logic states of PLC, you may step through the operation sequences by simulating them on the PC screen. You can also change the ladder logic program and test the new code using the simulator, **all without affecting the actual machine operation**. This is perhaps the greatest advantage of the TRiLOGI program development environment -- enabling the programmer to test his code instantly without worrying that something may break as a result. When the simulation yields satisfactory results, simply download the new program to the controller by pressing <Ctrl-T> and the actual machine will run in the predictable manner as indicated by the simulation.

Note: TRiLOGI's simulator will be suspended temporarily when the <F8> key is pressed. This is to preserve the current contents of the timer registers so that the programmer has time to examine them. To continue simulation, simply press the <P> key to release the simulator from the "System Paused" mode.

B. On-Line Monitoring & Control

With TRiLOGI Version 3.1 or higher you have direct control of the PLC operation from within the program. You can enter this mode by selecting the "On-Line Mon/Control" command from the "Controller" main menu, or by pressing the "Ctrl-M" hotkey. A screen similar to the simulator will appear with the flashing title "On-Line Monitoring & Control" along the top of the screen. The following are what may be done in this mode:

Monitoring

TRiLOGI continuously monitors the I/O logic states and present values of the timers and counters of the controller and displays them on screen. You may scroll up and down any I/O window using the cursor keys and the <PgUp> and <PgDn> keys to examine I/Os that are outside the present page. A highlight bar will appear when an I/O window is selected (its border is highlighted). The location of this highlight bar indicates the particular I/O bit **selected**.

Force Setting/Resetting I/O Bits

If you hit <Enter> key while in this mode, the selected I/O bit of the controller will be forced to toggle (change state) by TRiLOGI using host link commands. If the selected bit is a physical input bit or has been assigned to an output coil controlled by the ladder diagram, it will only be toggled for one-scan time. After that the controller will refresh its input/output according to the actual states of the physical inputs and outputs determined by the outcome of the ladder program. This is sometimes useful during program testing or debugging for temporarily overriding an I/O that does not respond as predicted.

Suspending PLC's Ladder Program

You can suspend the operation of the controller at any time by pressing the <P> key. A warning message will appear and a flashing sign "System Paused" will be displayed on the upper right hand corner. When the controller is suspended, its ladder

program will not be executed until it is resumed by pressing the <P> key again. At this time you can force set or reset any relay or output bits. This is convenient during programming or debugging as you can control the output driver to bring any physical component to any desired locations effortlessly.

C. Ladder Monitoring

You can also monitor the logic states of I/Os directly on the ladder diagram by selecting the "Ladder Monitoring" commands in the "Controller" or by pressing <Ctrl-T> . When you enter the "Ladder Monitoring" mode TRiLOGI will continuously monitor the controller's I/O logic states and display any "ON" I/O bit with highlighted label names on the ladder diagram. You can still scroll up/down the ladder programs while performing ladder monitoring, using the cursor keys, <PgUP> <PgDn> and <Ctrl-PgUp> and <Ctrl-PgDn>, etc. However, you may not use the left/right cursor keys to observe logic states of I/Os outside the current screen.

Note: On-line control/monitoring and Ladder monitoring are achieved by continuously sending host link commands to the PLC and analyzing the response strings immediately in order to update the I/O tables. Since the controller must spare some time to process the host-link commands, the overall scan time will slow down during on-line or ladder monitoring. Take precaution that programs which require fast scan-time, such as capturing encoder pulses or counters fed by the 0.01s and 0.02s clock sources, may lose some accuracy.

7. Uploading Ladder Program from PLC

If you are using TRiLOGI Version 3.2 or higher, it is possible to retrieve the compiled code from the PLC's EEPROM and re-construct them into ladder circuits. To perform uploading, open the "Controller" pull down menu and select the new item "Target Access". A pop-up menu with two items "Set Password" and "Retrieve PLC's Ladder" will appear. Select "Retrieve PLC's Ladder" and you will be prompted to confirm your wish to obtain the ladder program from the PLC.

Note that since the I/O label names and comments defined in the original program were never saved in the PLC, the re-constructed ladder diagram can only make use of the I/O labels defined in the currently opened file. Since the uploaded program replaces all the existing ladder circuits, make sure that you keep a backup copy if you do not wish to lose the contents of the currently opened file.

If an I/O used in the PLC's code is not defined in the current file, the program will prompt you to enter the label name. You can use the default name by pressing the <ESC> key. A default name defines an input as "In1", "In2"..., output as "Out1", "Out2"... etc.

Password Security

A password of 1 to 6 characters may be defined by the users by selecting the "Set Password" item from the "Target Access" menu. Once defined, the target PLC program may not be uploaded unless the same password is entered.

If you wish to change the password, select the "Set Password" item and you will be prompted to enter the original password. If the correct password is entered, you will be prompted to enter the new password. If you simply press the <Enter> key without entering any character, the original password will be cleared and the user may freely upload the PLC code.

Note: The password will also be cleared each time you perform a "Program Transfer" which will overwrite the existing ladder program.