

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Schneider Electric / Square D SY/MAX Class 8020 SCP-424* at our website: ***Click HERE***

1 MODEL 400 PROCESSOR OVERVIEW

1.1 Description

This bulletin describes the hardware and firmware features and installation procedures for the four types of SY/MAX® Model 400 Processors.

All versions of the SY/MAX Model 400 are single-width modules that may be installed into any SY/MAX digital or register rack assembly.

The Model 400 contains a versatile and powerful instruction set that performs over 100 functions. The memory in the Model 400 provides up to 16,000 words of user programming memory and allows control of up to 4,000 digital inputs and outputs in small to medium sized control applications.

Two serial communication ports on the Model 400 support a direct interface to other SY/MAX equipment to include programmable controllers and Network Interface modules (NIMs). The NIMs provide the SY/MAX devices with access to the SY/NET® high-speed network for local area network communication (LAN) facilities.

The Model 400 offers a real-time clock/calendar that may be used for interval timing of task execution and scanning operations. The clock/calendar and processor memory are additionally supported by an onboard lithium battery that allows the clock accuracy and contents of memory to be maintained when power is removed from the Model 400. The charge levels for the onboard lithium battery and the batteries in the SY/MAX power supply are monitored, and a front panel "BATTERY LOW" LED indicates when either or both batteries require replacement.

For added security, a "RUN" mode on the front panel keyswitch or an onboard jumper prevents online programming of the Model 400. A front-panel "WRITE PROTECT" LED indicates when the memory is write protected and whether the key switch or jumper is enabled. Software security (including program view inhibit) is also available through the use of a password.

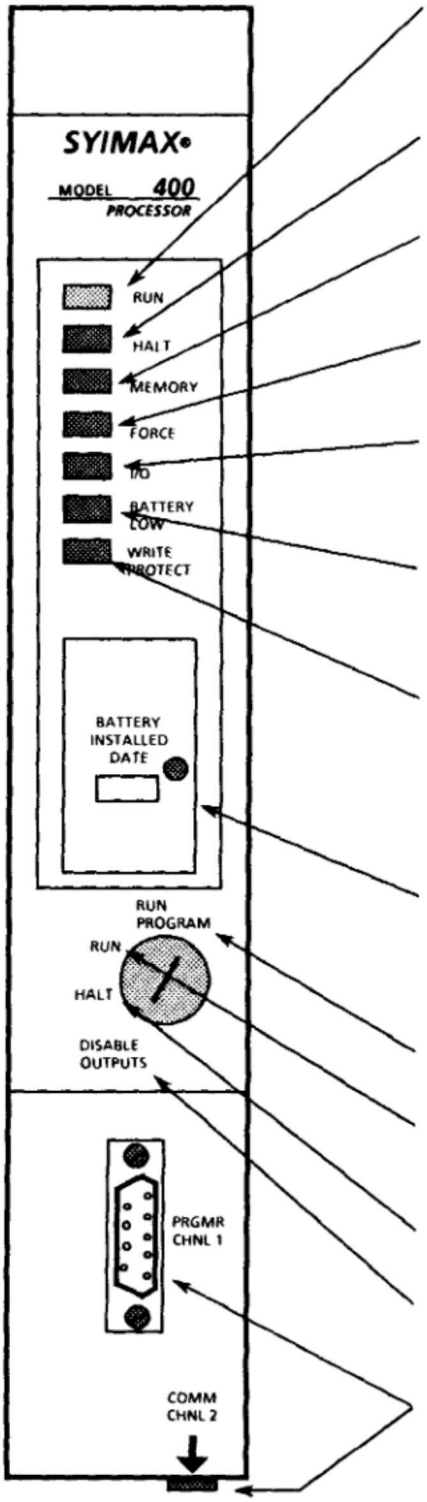
CAUTION

The Model 400 is compatible with the family of SY/MAX devices and is physically interchangeable. If a Model 400 is substituted for another processor, the user must be aware that system response characteristics may change. Refer to Section 3.1 of this bulletin for a discussion of compatibility.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1.2 Front Panel Features

STATUS INDICATORS (LEDs)



RUN (GREEN) - When ON steady, the processor is scanning the ladder diagram program and operating on I/O's. When FLASHING, the processor is operating on ladder diagram program, but is not energizing any outputs (Disable Outputs mode).

HALT (RED) - When ON steady or FLASHING, the processor has halted its execution and is no longer scanning the ladder diagram program.

MEMORY (RED) - When ON steady, the HALT light also flashes, indicating the processor has halted due to a memory error. Refer to Appendix B, "Error Codes/Troubleshooting".

FORCE (RED) - When ON steady or FLASHING, one or several I/O have been forced to an ON or OFF state thereby overriding the ladder diagram program.

I/O (RED) - When ON steady the HALT light also flashes, indicating the processor has halted due to a malfunction in the I/O system. The I/O system is regarded as any I/O or register module that the processor controls in a rack assembly.

BATTERY LOW (RED) - When ON steady, indicates that the onboard lithium battery charge is low. When FLASHING, indicates that the power supply batteries are low. The ON steady condition takes precedence.

WRITE PROTECT (RED) - When ON steady, indicates that the user memory is protected by the keyswitch positioned in the RUN mode and/or the internal write-protect jumper is in the NO PROGRAM position. When FLASHING, indicates some type of software-generated security is in effect. The ON steady condition takes precedence.

BATTERY ACCESS DOOR - Used to gain access to the onboard lithium backup battery for installation and replacement.

KEYSWITCH

RUN/PROGRAM. In this mode, the processor executes the ladder program and allows changes to be made to the program.

RUN. *In this mode, the processor executes the ladder program but **does not** allow changes to be made to the program or forcing to be implemented or changed.*

HALT. In this mode, all outputs are turned OFF and the processor *stops* executing the ladder program.

DISABLE OUTPUTS. In this mode, all outputs are turned OFF and the processor continues to execute the ladder program.

COMMUNICATION PORTS

RS-422 serial differential port (COMM 1) for connecting programming and peripheral equipment. RS-422 serial differential port (COMM 2) for connecting inter-processor communications, printers, ASCII devices, D-Log modules, etc.

Figure 1.1 Front Panel Identification

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2 SPECIFICATIONS

2.1 Model 400 Specifications

2.1.1 ELECTRICAL SPECIFICATIONS

Current Draw on SY/MAX Power Supply ..... 3500 mA (2500 mA for SCP-401). The PS-10, 11, 40, or 41 power supplies should NOT be used due to higher current requirements of the Model 400.

Memory Support Time From SY/MAX Power Supply Alkaline D-Cell Batteries .... 4 month minimum (battery age less than two years). Primary backup power source for ladder program, storage memory, and the clock/calendar when the Model 400 is in a rack during a power outage. Battery voltage can be monitored via contact status (bit 17 of reg. 8176).

Onboard Battery .. 3.5 to 3.6V AA lithium (Tadiran TL-5104 or SAFT LS6). Battery voltage can be monitored via contact status (bit 32 of reg. 8176).

Memory Support Time From Onboard Battery 1 year minimum (unloaded battery less than two years old). Secondary backup power source for ladder program, storage memory, and clock/calendar when the Model 400 is in a rack during a power outage. Primary power when Model 400 is removed from the rack. Battery is replaceable without powering down the Model 400.

Undervoltage Lockout Circuit .... Halts and resets the Model 400 and removes it from the SY/MAX bus when incoming DC supply voltage falls below 4.6VDC.

2.1.2 ENVIRONMENTAL SPECIFICATIONS

Ambient Temperature Operational ..... 32° to 140°F (0° to 60°C)

Storage ..... –40° to 176°F (–40° to 80°C)

Relative Humidity .. 5–95%, non-condensing

Vibration ..... Vibrated in three axes from 5 to 14 Hz at 0.2" (5 mm) displacement, and 14 to 200 Hz (two G acceleration maximum) for 90 minutes per X, Y and Z axis. Dwell at resonance frequencies for 10 minutes.

Electrical Noise ..... Passes the following tests for noise:

- NEMA Part ICS 2-230 and IEC 65A Part 5 Section 2.6.2.4. (Showering Arc).
- ANSI / IEEE C37.90a, IEEE 472 and IEC 65A Part 5 Section 2.6.2.5. (Surge Withstand Capability).
- Chattering Relay (Landis) Test.
- Current Spike (Reversing motor) test.
- ESD Protection meets IEC 65A Part 5, Section 2.6.2.2.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2.1.3 PHYSICAL SPECIFICATIONS

Dimensions
(without key) ..... Width- 1.5" (3.8 cm)
(Figure 2.1) Height- 12.8" (32.5cm)
Depth- 7.1" (18.0cm)
(with key) ..... Key adds an additional 1.0 inch (2.5 cm) to the depth when installed.

Weight (Approx.) .. 4.2 pounds (1.9 kg)

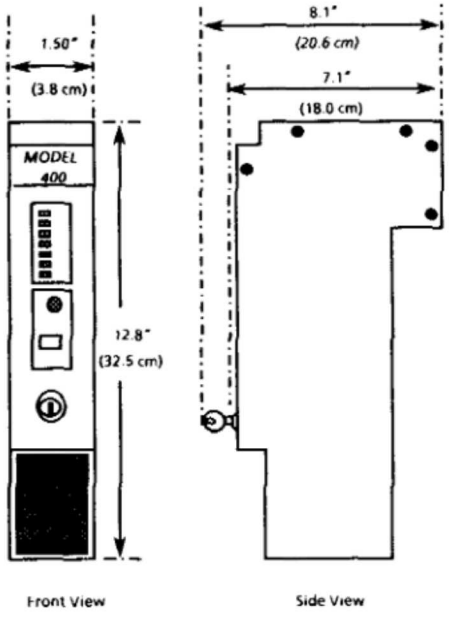


Figure 2.1 Model 400 Physical Dimensions

2.1.4 FUNCTIONAL SPECIFICATIONS

Scan Speed

SCP-401 ..... 4.1 milliseconds per K Boolean,
7.9 milliseconds per K nominal.

SCP-423, 424, 444 0.7 milliseconds per K Boolean,
2.9 milliseconds per K nominal.

NOTE: *I/O update from the image table for 128 local digital points will add a minimum of 0.3 milliseconds per scan. Refer to Section 14.2 for a detailed execution time description.*

Logic ..... Motorola® 68010 processor, Motorola 68881 math co-processor, and AMD 29116 for ladder scanning.

Real-Time Clock/Calendar .... Accuracy within one second per day @ 77°F (25°C), 16 seconds per day over full ranges:
temp. - 32 to 140°F (0–60°C)
relative humidity- 5–95%

Memory:

PROCESSOR TYPE	USER-MEMORY SIZE	MEMORY TYPE
SCP-401	4 K words	RAM
SCP-423	8 K words	RAM
SCP-424	16 K words	RAM
SCP-444	16 K words	RAM / UVPROM (up to 11K of memory can be stored in the UVPROM)

User Memory Utilization ..... 1 word per contact.

User Memory Overhead ..... 8 words

Front Panel LEDs .. RUN, HALT, MEMORY, *FORCE, I/O*, BATTERY LOW, WRITE PROTECT.

External I/O ..... Over 4,000 digital and over 3000 analog. Any mix in groups of 4, 8, 16, or 32 digital points or 4, 8, or 16 analog points per module.

Internal Relay Equivalents ..... 16 per unused register (4,000 nominal total).

Data Storage Registers ..... Up to 4000 16-bit integer registers or 2000 32-bit floating-point registers (floating-point not available in Type SCP-401).

Register Module Compatibility ..... All SY/MAX modules except Class 8030 Type CRM-115 and CRM-116 Bus Expander/ Terminator (see Section 3.1).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2.2 New Features

The following lists enhancements to the Model 400 that are not offered in the SY/MAX Models 300, 500, and 700 processors.

- **Real-time Clock** (Section 12.2).
- **Automatic Storage of Error Codes** (Control Register 8107).
- ***ASCII Input*** *(Section 10).*
- **Drum Sequencer** (Section 11).
- **Onboard Lithium Battery** (Section 12.1).
- ***RUN and RUN/PROGRAM Modes*** *(Keyswitch* Positions, Section 4).
- **Variable ROUTE Rungs** (Section 5.5).
- **Undervoltage Lockout Circuit** (Section 3.5).

2.3 Register Usage

The Model 400 addresses up to 4000 user-definable registers, each having a unique address value of 1 to 4000. These registers are located in an image table in the Model 400 processor and are used to reflect external I/O and internal relay status, store data, build shift registers, and accumulate time or count data in timers and counters. Additional registers are used to indicate overall programmable controller system status such as errors and keyswitch positions.

Each register is composed of 16 data bits and 16 status bits as illustrated in Figure 2.2. The data bits are accessible to the user for data storage and may be represented in binary or word form. The status bits cannot be changed or altered directly by the user, but can be programmed as contacts and monitored in the user memory.

Control registers 8097 to 8192 are used to control and monitor the basic operation of the Model 400. These registers are user-alterable, with exception of registers 8179 to 8192 which are read-only system status registers and can only be monitored. See Section 13 for details on the control registers.

The floating point (FLP) mode in the SCP-423, 424 and 444 processors combines two contiguous 16-bit data registers to form one 32-bit floating-point data register. FLP registers allow manipulation of numbers that contain floating decimal points. Refer to Section 7 for an explanation of "Floating Point Math" for the SCP-423, 424 and 444 processors.

Figure 2.3 illustrates the register usage for digital I/O points, analog I/O points, integer storage registers, and floating-point storage registers. Each digital I/O point occupies one bit of one register; 16 digital I/O points requires one complete register. Each analog I/O point occupies all 16 bits of one register and two complete registers are needed for each floating-point register.

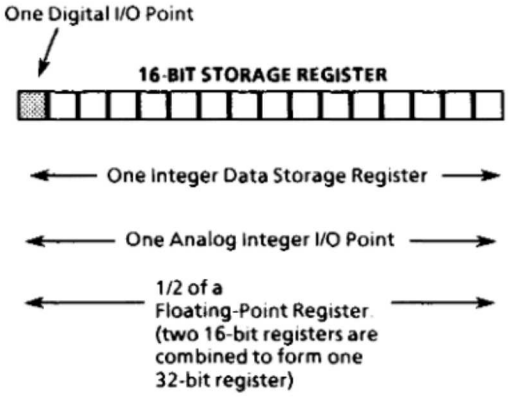


Figure 2.3 Register Use

The actual hardware I/O capacity of the Model 400 is over 4000 digital points and 3000 analog points. Typically, the maximum 16,000 word user memory is exceeded before the hardware maximum capacity is reached.

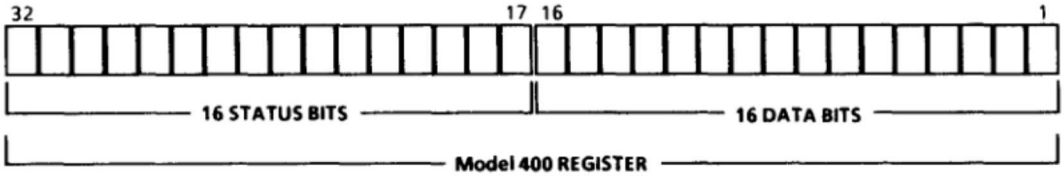


Figure 2.2 Model 400 Register Structure

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2.4 Instruction Set for All Types

Figure 2.4 lists all of the instructions available in the Model 400 processors Types SCP- 401, 423, 424, and 444. The SCP-401 only handles integer data and the asterisk(s) following certain instructions (such as floating-point instructions), are not available in the SCP-401 and should be noted accordingly.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP