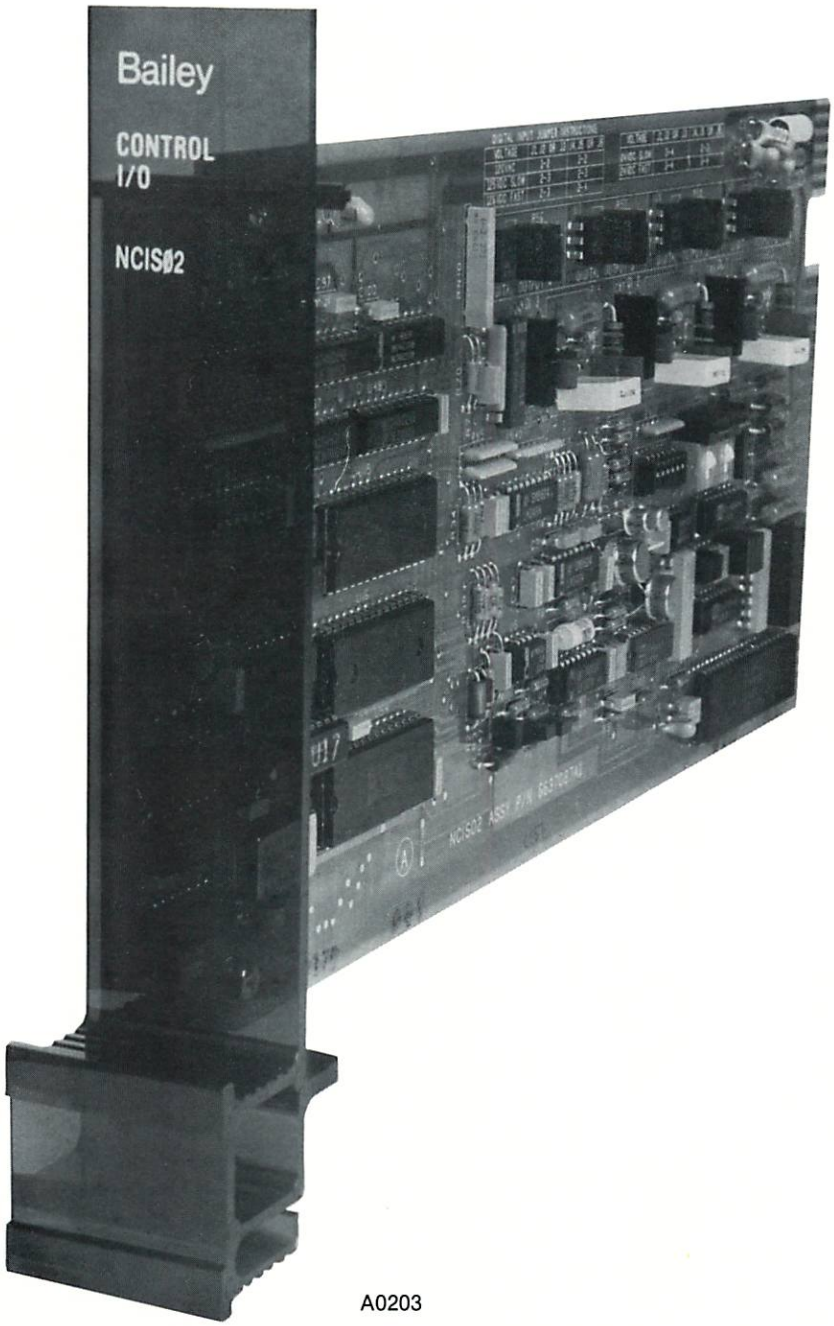
Bailey®
network 90®

# NCIS02 — Control Input/Output Slave




A0203

Bailey Controls

Product Instruction

E93-913-16

**WARNING** notices as used in this manual apply to hazards or unsafe practices which could result in personal injury or death.
**CAUTION** notices apply to hazards or unsafe practices which could result in property damage.
**NOTES** highlight procedures and contain information which assist the operator in understanding the information contained in this manual.

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# Section 1 — Introduction

## General Purpose

The Control I/O Slave Module (NCIS02) supplies analog and digital I/O from control processes to the Multi-Function Controller (MFC). The CIS performs analog to digital (A/D) and digital to analog (D/A) conversion on process I/O. The module provides four analog inputs, two analog outputs, three digital inputs, and four digital outputs. 64 Slave Modules can be supported by one MFC.

The CIS consists of a single printed circuit (PC) board and a plastic front plate. It occupies one slot in a Module Mounting Unit (MMU). Visible behind the module front plate is a red/green Light Emitting Diode (LED) that shows the operating status of the module.

## Section Content

This **Introduction** section contains a General Overview of CIS operation, a listing of related NETWORK 90 equipment, a Glossary of Terms, and a list of Related Documents.

The **Theory of Operation** Section provides a detailed explanation of the CIS operating functions and key circuitry.

The **Installation** section contains information needed to install the CIS in the NETWORK 90 system, and to set module switches for the desired configuration.

The **Operation** section contains information on normal module operation.

The **Troubleshooting** section describes methods of problem identification and corrective actions to take in the event of a module error.

**SPECIFICATIONS**

| | | |
|---|---|---|
| **DIGITAL I/O** | | |
| **Digital Inputs (3):** | Optically isolated<br>Input voltages: 24 V dc, 125 V dc, 120 V ac (all ± 10%) | |
| **Response Time, DC inputs (Typical)** | | |
| **Fast** | 1.5 msec | |
| **Slow** | 17 msec | |
| **Turn-on Voltage** | **(Minimum)** | **Current (MAX)** |
| **24 V dc** | 21.4 V dc | 3 mA |
| **125 V dc** | 95 V dc | 3 mA |
| **120 V ac** | 85 V ac | 5 mA @ 60 Hz |
| **Turn-off Voltage (Maximum)** | | |
| **24 V dc** | 12 V dc | |
| **125 V dc** | 60 V dc | |
| **120 V ac** | 42 V ac | |
| **"On" Input Current (Typical)** | | |
| **24 V dc** | 4.5 mA (@ Vin = 24 V dc) | |
| **125 V dc** | 5 mA (@ Vin = 125 V dc) | |
| **120 V ac** | 6 mA (@ Vin = 120 V ac) | |
| **"Off" Leakage Current (Maximum)** | | |
| **24 V dc** | 10 uA (@ Vin $\leq$ 12 V dc) | |
| **125 V dc** | 10 uA (@ Vin $\leq$ 60 V dc) | |
| **120 V ac** | 1.6 mA (@ Vin $\leq$ 42 V ac, 60 Hz) | |
| **Digital Outputs (4)** | Open collector, optically isolated | |
| **"Off" Output Voltage** | $V_{I/O}$ (Nominal 24 V dc) | |
| **"ON" Output Voltage** | 2.4 V dc Max | |
| **"Off" Output Current** | 10 uA Max | |
| **"On" Output Current** | 250 mA Max | |
| **ANALOG I/O** | | |
| **Analog Inputs (4)** | 1-5 V dc (differential)<br>Termination module or termination unit configured to accept:<br>Powered or unpowered current (4-20 mA)<br>Single-ended or differential voltage (1-5 V dc) | |
| **Input Impedance** | > 1 Megohm | |

## SPECIFICATIONS (continued)

| | |
|---|---|
| **Common Mode Voltage** | ±10 V dc |
| **Normal Mode Rejection** | 75 dB Minimum @ 60 Hz |
| **Common Mode Rejection** | 90 dB Minimum @ 60 Hz |
| **Analog Outputs (2)** | 4-20 mA or 1-5 V dc |
| **Output Load** | |
| **Current Mode** | 600 ohms (Max), 600 millihenries (Max) |
| **Voltage Mode** | >250 Kohms (Min) |
| **Power** | +5 V dc at 330 mA (1.65 W), Max<br>+15 V dc at 35 mA (525 mW), Max<br>−15 V dc at 30 mA (450 mW), Max<br>+24 V dc at 50 mA (1.2 W), Max |
| **A/D Resolution** | 12 bits for analog inputs<br>10 bits for analog outputs |
| **Mounting** | Occupies one slot in a standard NETWORK 90 Module Mounting Unit. |
| **Certification** | CSA certified for use as process control equipment in an ordinary (non-hazardous) location. |
| **Environmental Ambient Temperature** | 0° to 70°C (32° to 158°F) |
| **Humidity** | 5% - 90% R.H. (±5%) up to 55°C (131°F) (non-condensing)<br>5% - 40% R.H. (±5%) above 55°C (131°F) (non-condensing) |
| **Altitude** | Sea Level to 3 Km |
| **Air Quality** | Non-Corrosive |

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

*TABLE 1-1 — P1 Edge Connector Pinouts*

| PIN | SIGNAL | PIN | SIGNAL |
|---|---|---|---|
| 1 | +5 V dc | 2 | +5 V dc |
| 3 | not used | 4 | not used |
| 5 | Common | 6 | Common |
| 7 | +15 V dc | 8 | −15 V dc |
| 9 | Power Fail Interrupt (PFI)* | 10 | PFI* |
| | | 12 | not used |
| 11 | not used | | |

*Pins 9 and 10 are connected

*TABLE 1-2 — P2 Edge Connector Pinouts*

| PIN | FUNCTION |
|---|---|
| 1 | D1 |
| 2 | D0 |
| 3 | D3 |
| 4 | D2 |
| 5 | D5 |
| 6 | D4 |
| 7 | D7 |
| 8 | D6 |
| 9 | CLOCK |
| 10 | SYNC |
| 11 | N/C |
| 12 | COMMON |

*TABLE 1-3 — P3 Edge Connector Pinouts*

| PIN | SIGNAL | PIN | SIGNAL |
|---|---|---|---|
| 1 | Digital Output 1− | A | Digital Output 1+ |
| 2 | Digital Output 2− | B | Digital Output 2+ |
| 3 | Digital Output 3− | C | Digital Output 3+ |
| 4 | Digital Output 4− | D | Digital Output 4+ |
| 5 | N/C | E | N/C |
| 6 | Digital Input 1− | F | Digital Input 1+ |
| 7 | Digital Input 2− | H | Digital Input 2+ |
| 8 | Digital Input 3− | J | Digital Input 3+ |
| 9 | +24 V dc | K | N/C |
| 10 | Analog Output 1− | L | Analog Output 1+ |
| 11 | Analog Output 2− | M | Analog Output 2+ |
| 12 | Analog Input 1− | N | Analog Input 1+ |
| 13 | Analog Input 2− | P | Analog Input 2+ |
| 14 | Analog Input 3− | R | Analog Input 3+ |
| 15 | Analog Input 4− | S | Analog Input 4+ |

## Related Equipment

| Nomenclature | Description |
|---|---|
| NMFC01/02/03/04 | Multi-Function Controller |
| NDCS02/03 | Digital Control Station |
| NTCS02 | Controller Slave Termination Unit |
| NICS01 | Controller Slave Termination Module |
| NIDS01 | Digital Station Termination Module |
| NKTU01 | Standard module to termination unit cable |
| NKTU02 | Module to termination module cable |
| NKTM01/02 | Module to termination module ribbon cable |
| NKDS01/02 | Digital Station Cable |
| NKTD01 | Digital Station Cable |
| P/N 6634408 | Ribbon cable connecting NICS01 and NIDS01 |

## Glossary

**Multifunction Controller (NMFC0□)**

Powerful NETWORK 90 controller module. Receives digital inputs and digitized analog inputs from slave modules, and performs process control functions and computations. Four versions:

NMFC01; Standard Versions

NMFC02; BASIC programming for user programmed control strategies

NMFC03; BASIC and C programming capability

NMFC04; Single board width replacement of NMFC01

**Module Mounting Unit (MMU)**

Mounting rack in NETWORK 90 cabinet which provides housing for up to 12 modules.

**Termination Module (NICS01)**

Terminates analog and digital signal wiring from field process and is mounted in Termination Mounting Unit (TMU).

**Termination Unit (NTCS02)**

Terminates analog and digital signal wiring from field process, and is mounted on a Field Termination Panel (FTP).

**Expander Bus**

Parallel communication bus located on the bottom of MMU backplane. Dipshunts are inserted in sockets to make Expander Bus continuous between modules in the MMU. Provides communication from slave modules to MFC.

## Glossary (continued)

| | |
|---|---|
| **Slave Module** | Module which provides I/O to a master module such as the MFC or Logic Master Module (LMM) over the Expander Bus. Slave modules are usually non-intelligent and require the master to operate. |
| **Digital Control Station** | Panel mounted station which allows an operator to adjust setpoints, control output, transfer levels of control, and select digital readouts. |
| **Digital Input/Output (DI/DO)** | Input or output value which has two states representing, for example, a device which is "on" or "off", or a switch which is "open" or "closed". |
| **Analog Input/Output (AI/AO)** | Input or output which can have a continuous range of values, 1 to 5 volts or 4 to 20 milliamps for example. |

## Related Documents

Multi-Function Controller

NMFC01/02; E93-906-1
NMFC03; E93-906-7
NMFC04; E93-906-12

Termination Unit Manual; E93-911

Digital Control Station; E93-902-1

# Section 2 — Theory of Operation

## CIS Functions

Functionally, the CIS digitizes inputs from various process points in the field and provides them to a MFC. It also provides outputs for final drive devices that control the user's processes. The module has circuitry which:

1. Converts analog signals from process points and devices to the digital values that the Multi-Function Controller can read.

2. Converts digital signals from the Multi-Function Controller to the analog signals that control various process points and devices.

3. Provides isolation and passes digital input and output signals between the MFC and digital devices in the field.

Figure 2-1 shows a block diagram of the CIS.

## Expander Bus Interface

The CIS connects to the Expander Bus on the MMU Backplane through its P2 connector. A custom integrated circuit on the CIS performs the module interface to the Expander Bus allowing the CIS to receive data from, and send data to the MFC. Messages to the CIS from the MFC contain a destination address that matches the hardware address, set by dipswitch, on the Slave.

## Analog I/O Circuitry

The analog input circuitry receives analog signals from the termination unit, and digitizes them to a 12-bit binary number. The CIS can digitize signals from .75 to 5.25 V dc, giving each bit a weight of 1 millivolt. The termination unit is configurable to accept single ended or differential 1 to 5 V dc or powered or unpowered 4 to 20 mA inputs.

Circuitry on the CIS generates accurate 1 and 5 V dc references and applies them to the analog input section. This allows the CIS to correct for offset voltages and bias currents in the analog circuitry. This calibration is performed continuously to correct for drift and temperature variations as well.

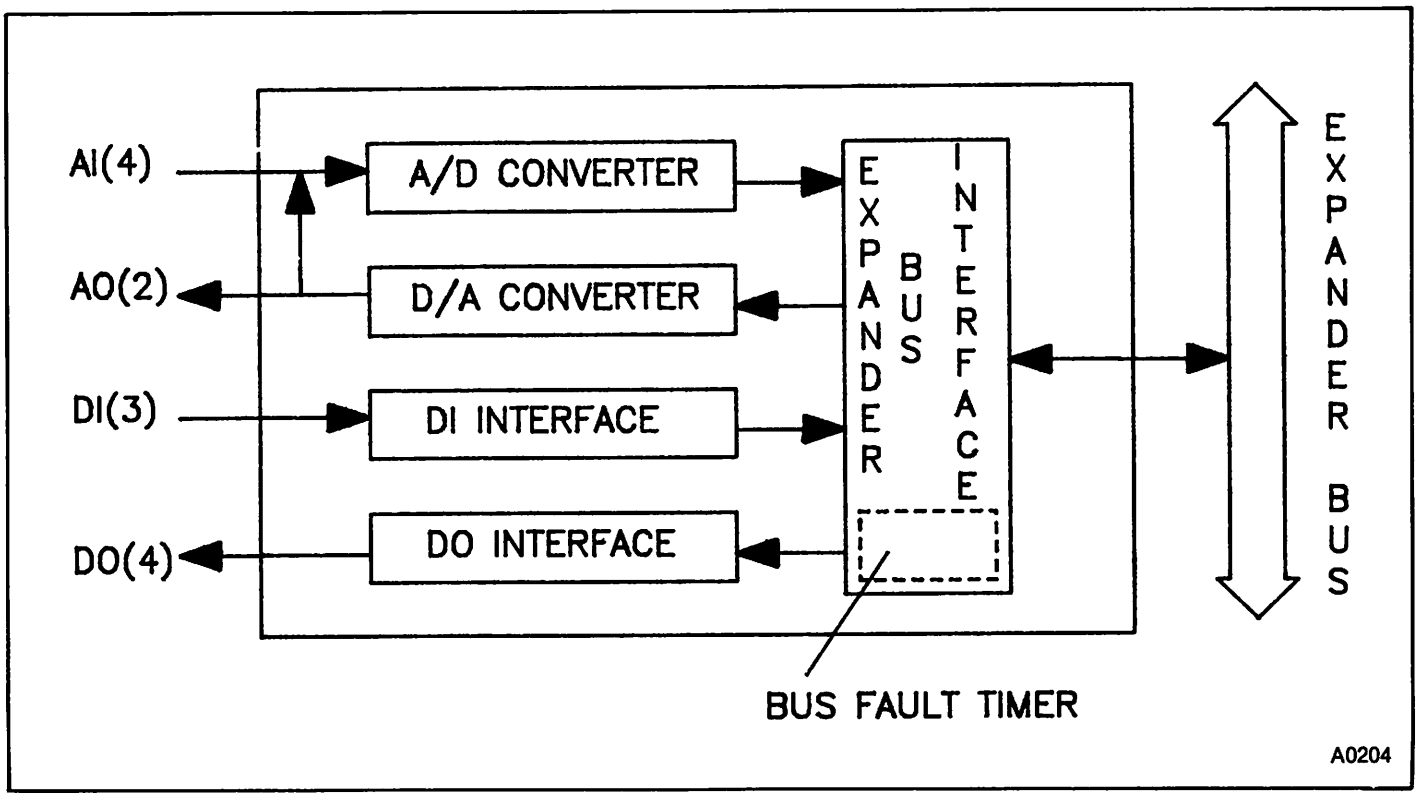


*FIGURE 2-1 — CIS Functional Block Diagram*

The analog output circuitry converts digital data from the MFC to two independent analog outputs. These outputs are also fed back to the analog input section and are monitored by the MFC. A dipswitch sets these outputs for either 1 to 5 V dc or 4 to 20 mA. Users can choose the output mode for each output independently.

## Digital I/O Circuitry

The CIS has 3 digital inputs which are independently configurable to accept 24 or 125 V dc, or 120 V ac. Also, the 24 and 125 V dc inputs have jumper selectable "fast" or "slow" response (turn-on/turn-off) times. Fast response time is 1.5 milliseconds and slow response time is 17 milliseconds. The slow response time feature provides input filtering in noisy environments.

The CIS provides four isolated, open-collector digital outputs. Each of these outputs can sink 250 milliamps at 24 V dc.

## Error Checking/ Default Settings

The MFC checks Slave status, analog outputs, and calibration voltages while on-line. If a Slave problem is detected, the MFC can "continue on error" or "trip", depending on the MFC configuration. If continue on error is selected, the MFC continues to update analog outputs (AO) and digital outputs (DO). If trip is selected, the MFC goes into "error mode" ; AOs hold present value, and the DOs turn off.

**Bus Fault Timer** The Bus Fault Timer is a one-shot timer which is reset by the Expander Bus Clock, generated by the MFC. Should the bus clock stop, the Bus Fault Timer "times out" in 10 milliseconds de-energizing the digital outputs, and setting the analog outputs to their default values. The default values are "hold present value", or "go to powerup state". The powerup state is selectable as 0% or 100% of the analog output (1 or 5 V dc for voltage mode ; 4 or 20 milliamps for current mode).

## Status LED

The user can see a single, red/green Light Emitting Diode (LED) through the faceplate of the CIS. This Status LED shows the operating state of the CIS/MFC. See **Status LED** in Section 4, Operation.

# Section 3 — Installation

## General Handling Considerations

Upon receipt of the CIS module the user should:

- Examine the module immediately to make sure that it has sustained no damage in transit.
- Notify the nearest Bailey Sales/Service Office of any damage.
- File a claim for any damage with the transportation company that handled the shipment.
- Use the original packing material and/or container to store the module.
- Store the module in an environment with good air quality, free of extremes of temperature and humidity.

## Specific Handling Considerations

The Slave Module uses metal oxide semiconductor (MOS) devices that require special precautions during shipping and handling. Static discharge, improper grounding, and careless handling can damage these devices. To prevent such damage, follow these procedures:

- Keep the module in its special anti-static bag until you are ready to install it. Save the bag for future use.
- Ground the anti-static bag before opening it.
- Make sure all of the devices to which the module connects are properly grounded before connection.
- Avoid touching the circuitry when handling the module.

## Preparing for Installation

Before the user installs the CIS module, its termination unit (NTCS02), or termination module (NICS01), he must verify:

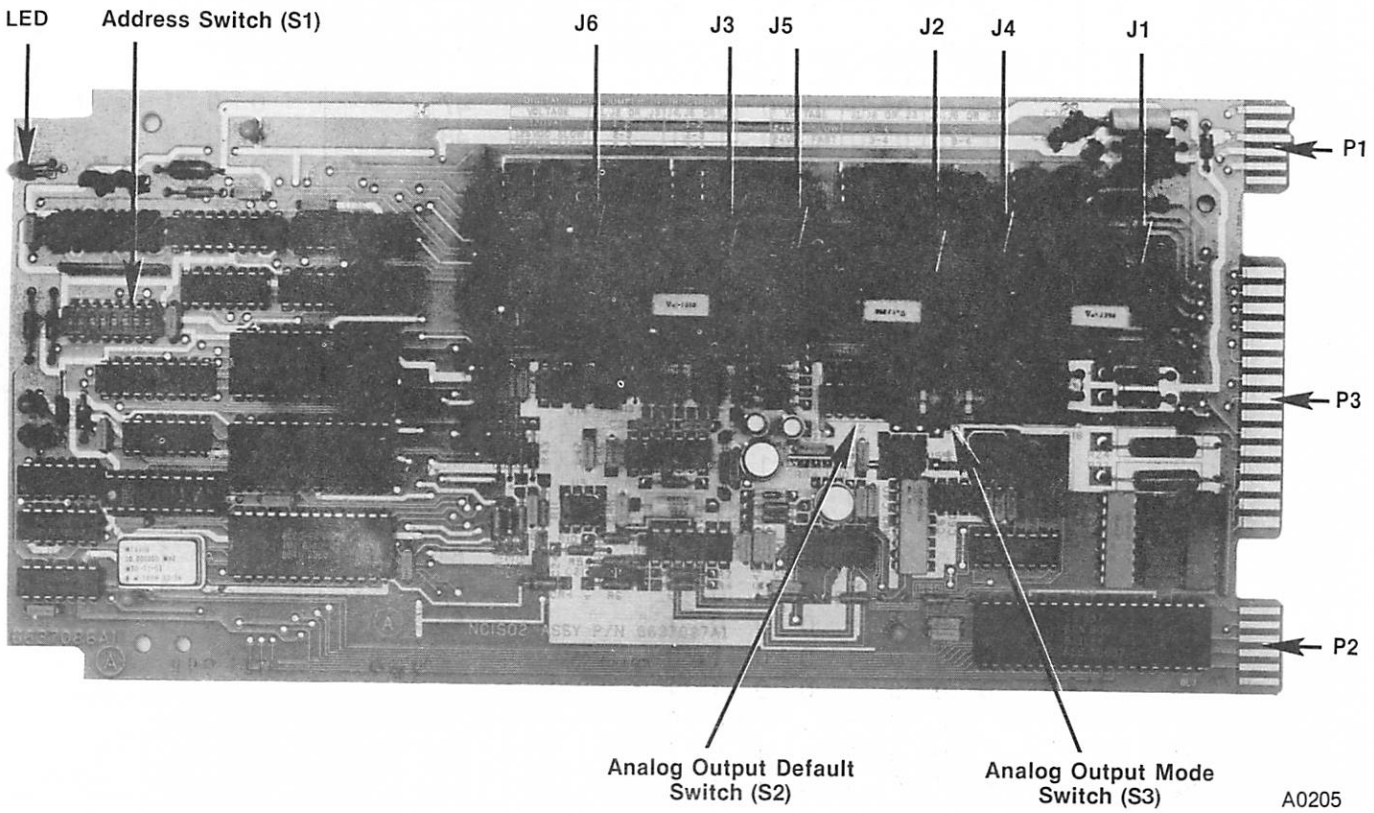


*FIGURE 3-1 — CIS Jumper and Switch Locations*

- The settings of the switches and jumpers on the CIS meet the requirements of his application.
- The strapping of the dipshunts on the NTCS02 meet the requirements of his application.
- Dipswitch settings on the NICS01 meet the requirements of his application.

## Setting the CIS Switches and Jumpers

### Setting the Address Switch

S1 is the eight contact dipswitch that defines the address of the CIS on the Expander Bus (Figure 3-1). The user must set the address before he installs the CIS.

The address is a binary number from 0 to 63. The user sets the address using the six least significant bits (LSB) of the address switch (contacts 3 through 8). Contacts 1 and 2 are unused and should be set to the "0" position. Table 3-1 lists valid CIS address switch settings.

*TABLE 3-1 — CIS Module Addresses*

0 = CLOSED = ON ; 1 = OPEN = OFF

| DECIMAL ADDRESS | CONTACT SETTING MSB 1 | 2 | 3 | 4 | 5 | 6 | 7 | LSB 8 |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 6 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 8 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 10 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 11 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 12 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| 14 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| 15 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 16 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 18 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 19 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| 20 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 21 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 |
| 22 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |

*TABLE 3-1 — CIS Module Addresses (continued)*

0 = CLOSED = ON; 1 = OPEN = OFF

| DECIMAL ADDRESS | CONTACT SETTING MSB 1 | 2 | 3 | 4 | 5 | 6 | 7 | LSB 8 |
|---|---|---|---|---|---|---|---|---|
| 23 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| 24 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 26 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |
| 27 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 |
| 28 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| 29 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 |
| 30 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |
| 31 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 32 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 33 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 34 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 35 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| 36 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 37 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| 30 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| 39 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| 40 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 41 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| 42 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 43 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 |
| 44 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| 45 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 |
| 46 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 |
| 47 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| 48 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 49 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| 50 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| 51 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| 52 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 53 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| 54 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| 55 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| 56 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 57 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| 58 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| 59 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| 60 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| 61 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| 62 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| 63 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |

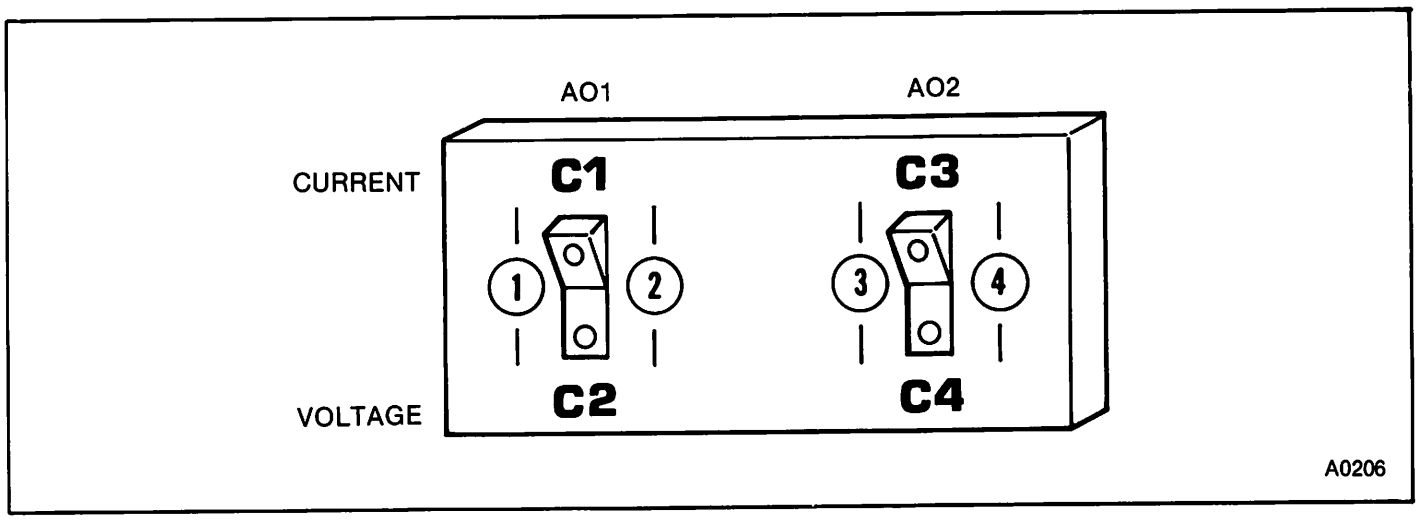


*FIGURE 3-2 — Analog Output Mode Switch (S3)*

### Setting the Analog Output Mode Switch

Dipswitch S3 (Figure 3-1) selects the output mode (Current; 4 to 20 mA or Voltage; 1 to 5 V dc) for each analog output. Figure 3-2 illustrates the switch settings.

For example: If the voltage range for analog output 1 is desired to be 1 to 5 V dc, then the rocker switch for analog output 1 is set to the C2 position.

### Setting the Analog Output Default Switch

The Analog Output Default Switch (S2) determines the value of CIS analog outputs at system powerup, and also their default values should the MFC stop activity on the Expander Bus. Figure 3-1 shows the switch location and Figure 3-3 illustrates the function of each switch contact.

Contacts 1 and 4 are unused and should be left in the OFF or OPEN position.

Contact 3 selects the powerup value for analog output 1. Powerup options are 0% or 100% of the analog output mode value. This is the value selected with the Analog Output Mode Switch (4 mA (0%) or 20 mA (100%) for current mode ; 1 V dc (0%) or 5 V dc (100%) for voltage mode). Contact 6 selects the "power up" value for analog output 2.

Contact 2 selects the analog output "time out" option for analog output 1. If the Bus Fault Timer expires, the digital outputs are de-energized and the analog outputs are set to their chosen default values. The default values are "hold present value" and "go to power-up state". Contact 5 selects the analog output "time out" value for analog output 2.

### Setting the Digital Input Jumpers

Options for the CIS digital inputs are selected by jumpers J1 through J6 on the CIS PC board (Figure 3-1). Each "J" designation consists of 4 jumper pins, and each digital input is defined by a pair of "J" designations (e.g. DI-1 defined by J1 and J4). Table 3-2 shows the jumper settings to obtain the desired digital input options. (Digital jumper settings are also silk-screened on the PC board.)

For example: to obtain a 125 V dc, slow setting for digital input 1, place jumpers across pins 2 and 3 of J1 and pins 2 and 3 of J4. To obtain the same setting for DI-2, jumper pins 2 and 3 of J2 and J5.

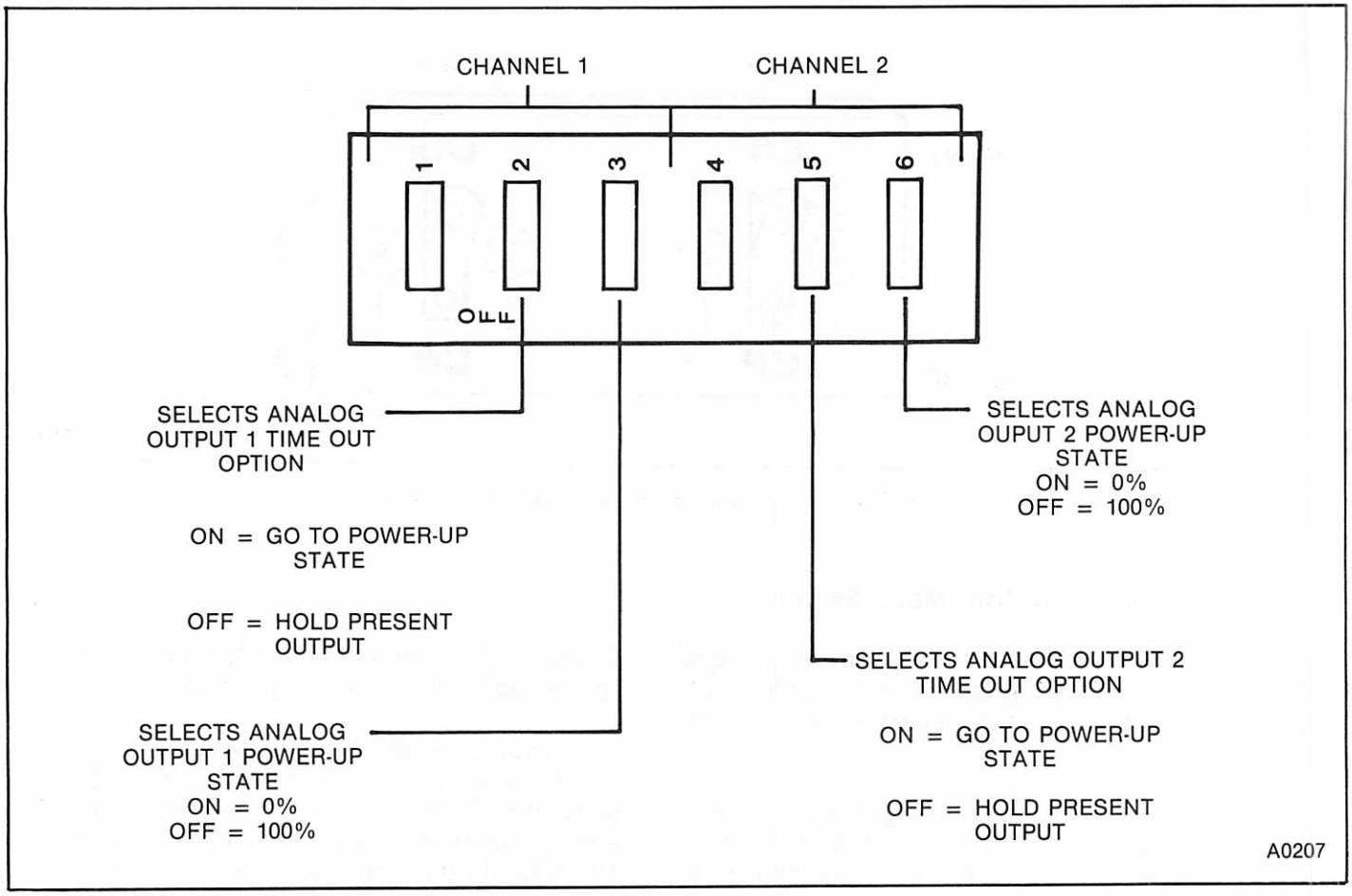


*FIGURE 3-3 — Analog Output Default Switch Definition (S2)*

*Table 3-2 — Digital Input Jumper Settings*

| DIGITAL INPUT TYPE | J1 (DI-1)<br>J2 (DI-2)<br>J3 (DI-3) | J4 (DI-1)<br>J5 (DI-2)<br>J6 (DI-3) |
|---|---|---|
| 120 V ac | 1-2 | 1-2 |
| 125 V dc, SLOW | 2-3 | 2-3 |
| 125 V dc, FAST | 2-3 | 3-4 |
| 24 V dc, SLOW | 3-4 | 2-3 |
| 24 V dc, FAST | 3-4 | 3-4 |

## Installing Dipshunts In The Expander Bus

Install 12-strap dipshunts, with all straps intact, in the Expander Bus sockets between the CIS and its associated MFC.

### Cabling

If Termination Unit NTCS02 is used, connect cable NKTU01 from the slot designated for the CIS in the Module Mounting Unit (MMU) (with the CIS removed) to the P1 receptacle on the NTCS02 as follows:

1. Attach the hooded card edge connector of cable NKTU01 to the appropriate MMU slot, from the rear, by squeezing the latches on the connector and lining up the rib on the connector with the notch in the MMU slot. Insert the connector into the slot until the latches "snap" securely into place when released.

2. Attach the other end of the cable to the P1 socket of the TCS by pushing the cable plug firmly into the socket until the plug latches connect securely to the sides of the socket.

If Termination Module NICS01 is used, connect cable NKTU02 or NKTM01 from the MMU to the Termination Mounting Unit (TMU) as follows:

1. Connect the cable to the CIS slot in the MMU (with the CIS removed) by performing Step 1 above.

2. Attach the other end of the cable to the slot designated for the ICS on the TMU in the same manner as described in Step 1.

## Inserting the CIS into the MMU

1. Verify the slot assignment for the CIS.

2. Verify that dipshunts are installed in the Expander Bus.

3. Align module with guide rails in the MMU.

4. Insert the CIS into the MMU slot and press on the plastic faceplate until the latch at the bottom of the faceplate snaps securely into the MMU.

## Preparing Termination Module or Termination Unit

Hardware inputs and outputs from the control process are connected to the CIS through the Termination Module NICS01 or the Termination Unit NTCS02. Refer to "Termination Unit Manual" E93-911 for setup and installation information for the termination unit.

**NOTE:** If a DCS will be used to bypass a CIS analog output, refer to Product Instruction E93-902-1 and E93-911.

# Section 4 — Operation

## Normal Module Operation

After configuring the CIS, inserting it into the MMU, and applying power, the Slave provides process I/O to the MFC. When the module is operating normally, the Status LED glows green. If the LED is not illuminated, this indicates that the MFC is operating, but has not established communication with the CIS, or that the MFC is in Configure Mode. If the LED is red, this indicates that the Expander Bus Clock has stopped and the outputs are in their default states (refer to **Troubleshooting** section for causes and corrective actions). Figure 4-1 shows the location of the Status LED.

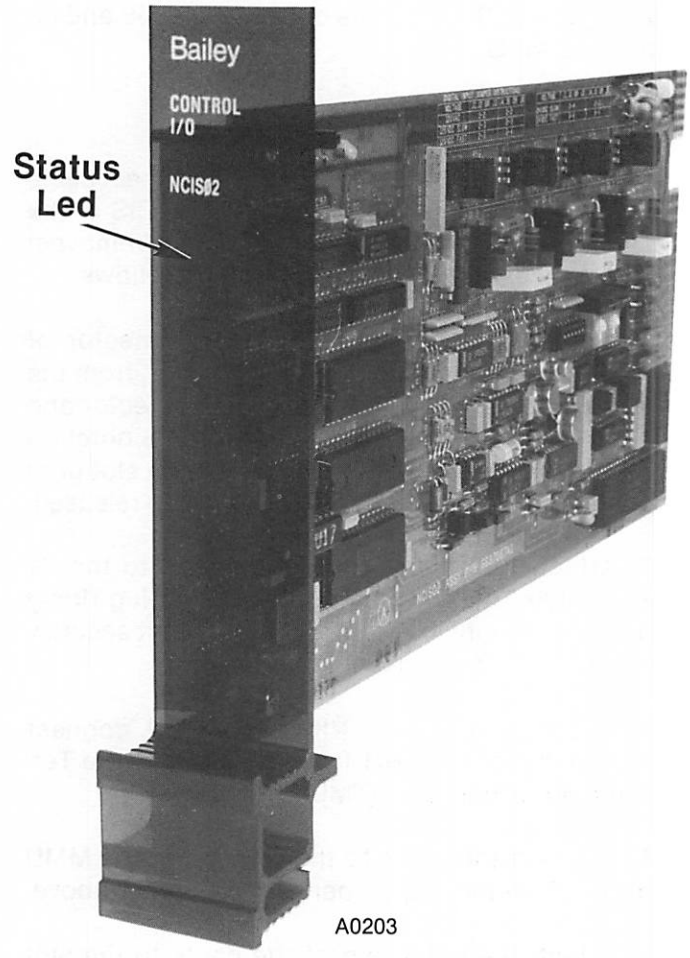


*FIGURE 4-1 — CIS Status LED*

# Section 5 — Troubleshooting

### CIS Error Indications

The MFC performs error checks on the CIS, and generates status reports accessible from a NETWORK 90 operator interface. The Status LED also indicates certain error conditions. Table 5-1 lists CIS error indications, probable causes for the error, and corrective action to take.

*TABLE 5-1 — CIS Troubleshooting*

| INDICATION | CAUSE | ACTION |
|---|---|---|
| Operator interface shows CIS status error, or OIU or MCS graphic display shows a CIS-related "bad quality" point | MFC detects problem with CIS | Check I/O SLAVE Status Report on "Module Status Screen", and take corrective action accordingly. (See "I/O Slave Status Report" below) |
| Status LED is red | Expander Bus Clock stopped due to MFC or Expander Bus problem | Check:<br>Expander Bus dip-shunts in place.<br><br>Modules plugged in completely. |

### I/O Slave Status Report

CIS-related problems are reported by the MFC in status reports accessible from a NETWORK 90 operator interface. The status reports appear on an Operator Interface Unit (OIU) or Management Command System (MCS) in "I/O SLAVE Status Reports" on the Module Status Screen. These status reports are of the form:

I/O SLAVE ERROR NUMBER (#), SLAVE ADDRESS (#),

BLOCK NUMBER (#)

The I/O SLAVE ERROR NUMBER indicates the specific problem. Refer to Table 5-2 for interpretation.

*TABLE 5-2 — CIS Status Report Error Definition*

| ERROR NUMBER | DEFINITION | CAUSE/CORRECTIVE ACTION |
|---|---|---|
| 1 | Slave missing or bad status | MFC cannot communicate with Slave due to:<br><br>Slave not inserted in MMU<br>Wrong address on Slave<br>Slave address or type wrong in MFC configuration<br>Expander Bus problem<br><br>Corrective Action:<br><br>Check Slave address, Expander Bus dipshunts, MFC configuration |
| 2 | Voltage reference on CIS out of tolerance | 1. Check common mode voltage at analog inputs<br><br>2. Replace CIS |
| 3 | Analog Input/Output out of tolerance | A0 out of tolerance: Load impedance may be out of range<br><br>AI out of tolerance: Voltage level below 0.75 V dc or above 5.25 V dc.<br>Excessive common mode voltage |

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