

INSTALLATION AND OPERATION MANUAL

STM-4201 STAGED TURBINE MODULE

SYSTEM CONCEPT

When using multiple turbines to deliver a single fuel product while performing line integrity testing at the beginning of delivery, it is necessary to start the turbines in a sequenced or staged order. In multi-turbine applications, if all turbines are started at the same time it becomes impossible for a mechanical leak detector to properly monitor the building pressure in the line and to perform the leak detection function. To accommodate the special requirements of multi-turbine applications, the STM-4201 has been designed both to control the sequencing of turbines and to operate with VMI's ISM-4080/4081 family of Integrated Shutdown Modules.

Note: It is recommended that the user be familiar with the installation and operation of the ISM-4080 and ISM-4081 products available from VMI.

The STM-4201 includes the following features:

- Interfacing to VMI's ISM-4080/4081 modules
- Automatic sequencing of up to four turbines
- Selection of 2, 3 or 4 turbine sequences
- Independent control of two 2-turbine sequences
- Automatic rotation of the lead turbine
- Detection of alarm signals from the ISMs
- Automatic shutdown on first alarm detection
- Automatic skipping of disabled turbines
- General remote alarm signal output
- Universal input and output voltage ratings
- Selectable 115/230 Vac module power

BASIC SYSTEM CHARACTERISTICS

The microcomputer based Staged Turbine Module controls the sequencing of multiple turbines used to deliver a single fuel product. The following statements outline the basic operation of the STM-4201 in a four turbine sequence. As previously noted, the STM controls the turbines through signaling of the associated ISM modules. Refer to Figure 1.

1. Following the application of power to the system, all turbines will be in the off condition and Turbine 1 will be designated as the lead turbine in the sequence.
2. With the detection of a dispensing request signal at the STM's Authorize A input, the first ISM module will be signaled to start Turbine 1.
3. Leak Detector 1 will monitor the pressure in the distribution line and validate that the line is tight. The ISM will return a Ready signal to the STM.
4. When the Ready 1 signal is received by the STM it will signal the second ISM in the sequence to turn on Turbine 2.
5. Because operating pressure has already been established in the line, Leak Detector 2 will validate that the line is tight and the second ISM will return a Ready signal to the STM.
6. This process is repeated until all turbines in the sequence are running.
7. When the dispensing request signal at the STM's Authorize A input is removed, all ISMs will be signaled to turn off their associated turbine. This will end fuel delivery.
8. Following the termination of fuel delivery, the lead turbine designator will be advanced to point to the second available turbine in the sequence. So, in this example, Turbine 2 will become the lead turbine when the next authorization signal is received.
9. If an ISM returns an Error signal, instead of a Ready signal, fuel delivery will be terminated. Fuel delivery may be reestablished by cycling the delivery request signal at the Authorize A input. When this is done the lead turbine designator will be incremented.
10. If the Error signal from an ISM is not cleared by the operator, that channel and its turbine will be removed from the sequence. This means that fuel delivery may be reestablished, but with fewer turbines in the sequence.
11. If the Error signal is actually caused by a line leak, restarting the dispensing of fuel will result in the detection of the leak by the next lead turbine. This routine may be repeated until all turbines are off line.

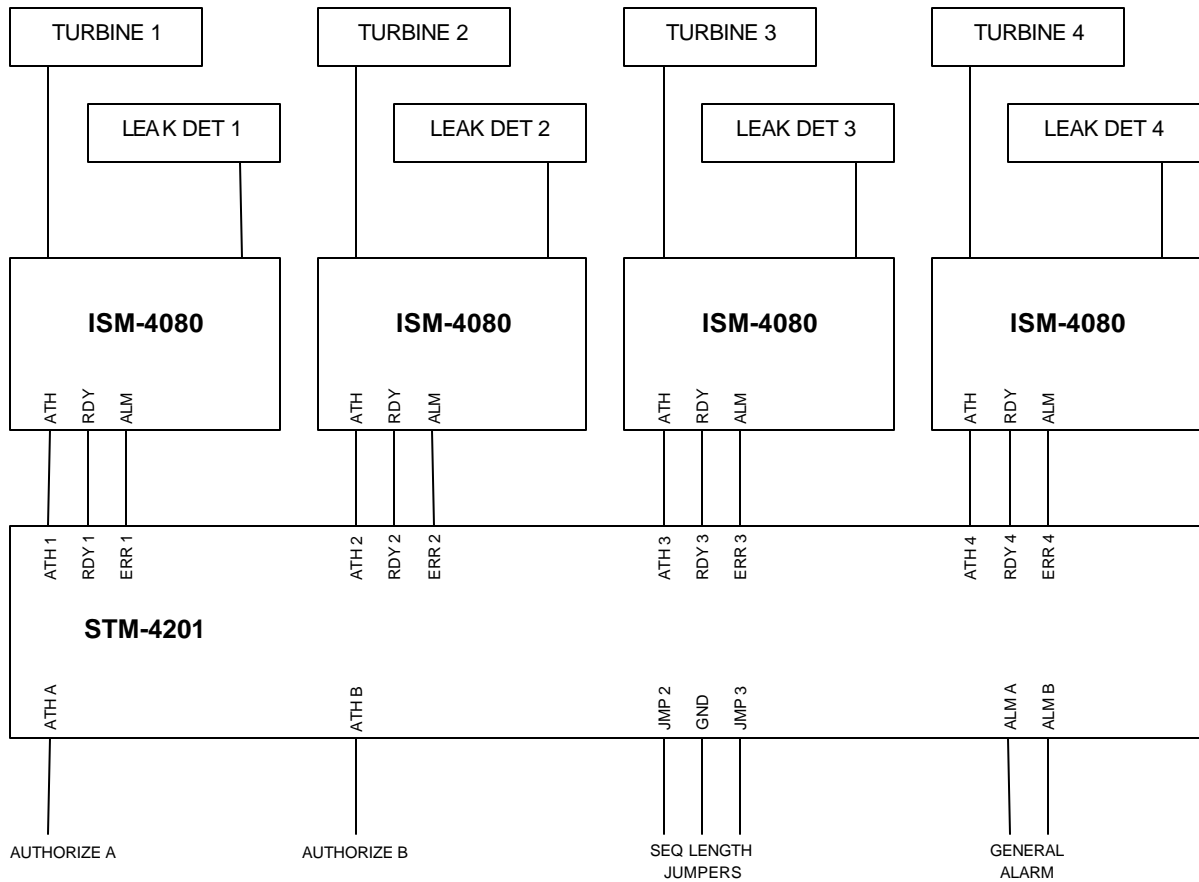


Figure 1 — STM-4201 Application Block Diagram

CONTROLLER LABELING

The following information is provided on the STM's labels. The installer should be familiar with this information.

- Controller name, model and serial number
- Voltage, current and load specifications
- Notice of application information
- Manufacture's name and telephone number

ENCLOSURE AND MOUNTING

The STM is packaged in a standard DIN-rail mountable enclosure. It is designed for operation in a non-hazardous environment such as an equipment room. It is recommended that the module be located

in the vicinity of the ISMs and pump contactors with which it is associated.

A section of DIN-rail mounting strip is provided with the STM. Secure this strip to a panel board using screws whose head does not project above the mounting surface of the rail. Following the secure mounting of the rail, snap the module onto the rail.

ELECTRICAL CONNECTIONS

Figure 2 illustrates the power connections for a 115 Vac mains circuit. Figure 3 illustrates the power connection for a 230 Vac mains circuits. These are the same connection as used on the ISM modules.

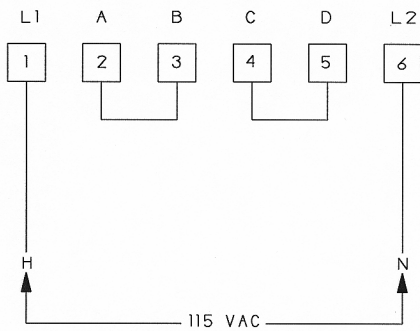


Figure 2 — 115 Vac Mains Connection

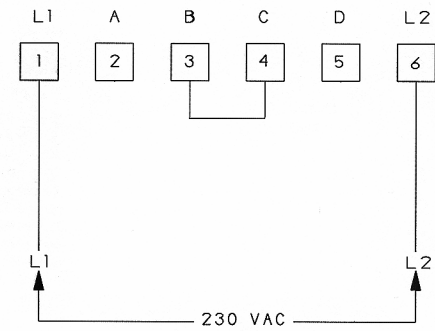


Figure 3 — 230 Vac Mains Connection

SEQUENCE LENGTH SELECTION

The STM-4201 can control multi-turbine applications containing two, three, or four turbines. If the four turbine sequence is selected, all four interface channels of the STM will be connected each to an ISM module. If the three turbine sequence is selected, only the first three interface channels will be used. If the two turbine sequence is selected, then the first two interface channels can be used to control two turbines in what is referred to as Group A, while the remaining two channels can be used to control two turbines in what is referred to as Group B.

To select the two channel configuration install a wire jumper between terminals 26 (GND) and 25 (JMP 2).

To select the three channel configuration install a jumper between terminals 26 (GND) and 27 (JMP 3).

To select the four channel configuration do not install any jumpers between terminals 25, 26 and 27.

NEUTRAL REFERENCE

Most dispensing authorization signals are rated at 115Vac with a neutral reference. This being the case, an AC neutral should be connected at terminal 19 (COM) as shown on the schematic attached to this manual. This neutral will serve as the reference for all input and output signals.

AUTHORIZATION INPUTS

For two, three and four turbine applications a dispensing authorization signal must be connected at terminal 22 (ATH A).

For two turbine applications a second dispensing authorization signal may be connected at terminal 23 (ATH B) to control the second two turbine sequence which is available in the mode.

ISM INTERCONNECTIONS

Three signals pass between the STM and the ISM associated with each turbine channel. These are the channel's authorization, ready, and error alarm signals. Refer to the schematic attached to this manual for specific terminal information. As previously noted, the reference for the STM's inputs and outputs is the neutral of the AC mains.

GENERAL ALARM OUTPUT

A general alarm is generated when the STM detects an alarms signal from any of the turbine channels. This signal is available as a contact closure across terminals 20 (ALM A) and 21 (ALM B). The source of the alarm may be determined by looking at the displays on the ISM modules.

EMERGENCY SHUT-OFF

It is the responsibility of the installer to develop an installation which provides for proper emergency shut-off function. Following are important comments.

- If the shut-off system breaks mains power to the pump contactor, voltage will be removed from the pump when the shut-off system is activated. This configuration will not be affected by installation of the STM or ISMs.
- If the shut-off system breaks mains power to the ISM module, the drive signal to the coil of the pump contactor will be removed when the shut-off system is activated. This configuration is adequate if it meets local codes.
- If the shut-off only disables the authorization signal, voltage will not be removed from either the pump or the ISM and the repressure cycle will not be disabled and could result in unexpected pump operation. This would not meet the requirements for a shut-off system.

ISM AUTHORIZATION BYPASS SWITCH

The ISM's Authorization Bypass Switch remains affective in applications with an STM. When this slide switch is in the NORMAL position the unit operates as described. When the switch is in the BYPASS position the channel's authorization input is shunted directly to the ISM's READY output. The turbine will not operate, but the ready response will allow the STM to continue processing the staged turbine sequence. This feature is particularly useful when it is necessary to remove a turbine from service without disabling the delivery of fuel.

SPECIFICATION

Input Voltage	115 Vac, 40 ma, 1 ph 230 Vac, 20 ma, 1 ph
Input Module Voltage Range	60 – 240 Vac
Typical Input Module Voltage and Current	115 Vac at 10 ma
Output SSR Rating	1A, 125/250 Vac

