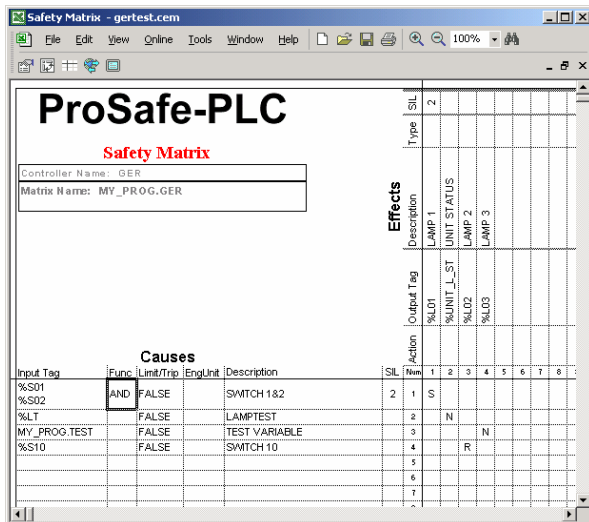


GS 48E21A00-00E-N



The Safety Matrix is a toolkit for the ProSafe-PLC that cuts configuration, testing, and maintenance in half by merging into one tool the traditionally separate steps of creating a cause & effects matrix diagram and configuring the safety system. It was developed as both a development tool and a methodology, and to be easy-to-use by a variety of plant personnel—from process (safety) engineers to operations and maintenance personnel.

The Safety Matrix provides:

- Straightforward, easy-to-learn method of documenting safety system requirements
- Easy-to-understand, graphical documentation to facilitate better review and maintenance
- Automatic generation of the safety system logic from the matrix logic for reduced development effort
- Automatic regeneration of the safety system logic when a change is made to the matrix for minimized documentation and maintenance efforts

Reducing Engineering Time & Expense

A cause & effects matrix identifies the possible causes of process events and their resulting effects. Traditionally, a matrix is developed as part of a safety specification to identify

relationships, which must then be converted to the logic to be executed by the safety system. As such, a traditional matrix serves only to ensure that the safety system requirements are defined thoroughly, requiring you to write a program that reflects the matrix logic. In addition, extensive testing is usually required to detect any potential errors, and users frequently build some form of hardwired mimic or matrix panel to convert the safety system's ladder logic back into the cause and effects matrix.

With the Safety Matrix, however, the matrix logic is automatically generated from a complete matrix worksheet. Besides reducing configuration significantly, this also eliminates errors associated with manually converting the matrix to logic. There is no need to do any additional programming, because I/O configuration details are entered within the matrix, as well. Moreover, it is seamlessly integrated with Control Simulator, which allows you to develop and test the matrix logic entirely on a single PC.

Minimizing Implementation & Maintenance Costs

The Safety Matrix also helps you maintain up-to-date documentation, because it automatically regenerates the logic when a change is made to the matrix. These modifications and any other user activities related to the matrix are logged and time-stamped in the system's integrated Sequence of Events Recorder (SOER) Viewer (shown above), thereby providing you security and change history.

Ensuring System Security

The Safety Matrix's security system, which provides multi-user, multi-password access and allows an administrator to assign up to 6 configurable levels, is built-in into the matrix itself. This means that such vital information resides with the matrix—not the PC of origin. The various access levels, which can range from read-only to full change control and downloading capabilities, provide plant personnel the information they require without jeopardizing system integrity.

Providing Ease of Use

The Safety Matrix is easy for non-control engineers to learn and use due to the familiar spreadsheet-based user interface which animates the American Petroleum Institute (API) 14C standard. It also includes customizable displays to further facilitate ease-of-use.

The software includes:

- The Safety Matrix Configuration Program, which enables graphical configuration and documentation of a cause and effects matrix
- The Safety Matrix Function Block Library, which executes the completed matrix within any ProSafe-PLC control module or Control Simulator
- The Safety Matrix Operations and Maintenance Program for online monitoring and secured maintenance

These seamlessly integrated components work in concert with the other ProSafe-PLC engineering tools (PLC SET, Control Simulator, and the SOER Viewer) to provide a complete development, testing, troubleshooting, training, and operation environment for automating the cause and effects methodology.

Delivering Intuitive, Graphical Configuration

As with the PLC SET (System Engineering Tool) software, Safety Matrix configuration data is sent and stored in the controller in an uncompiled format. Thus, this data, including tags, notes, descriptions, and security levels, can be viewed in the same graphical format in which it was created. The configuration can also be automatically uploaded from a running controller, which eliminates the need to maintain back-up files.

In configuring the ProSafe-PLC, the Safety Matrix is used to relate process events (inputs or causes) to shutdown devices (outputs or effects) by listing all possible causes on one axis and all effects on the other. The relation of causes to effects is defined by marking the appropriate box (intersection) in the matrix.

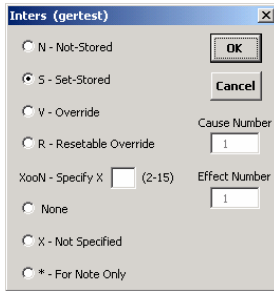
Causes

As shown above, causes are configured by clicking on any cell within the row or column identified as a cause. A dialog box enables entry of the details supporting each cause. The application supports a wide variety of cause types, up to 3 inputs per cause, and a variety of logic functions to be performed on the inputs to generate the cause. This flexibility allows complete implementation and documentation of the safety logic in the Matrix. With complete implementation, there is no need for external signal conditioning logic, which minimizes much of the inherent communication and troubleshooting benefits of the cause and effects methodology.

Effects

As shown above, effects are configured by clicking on any cell within the row or column identified as an effect. The dialog box enables entry of the details supporting each effect.

Intersections



As shown above, intersections define relationships between the causes and the effects.

Facilitating Easy Logic Execution

The Safety Matrix Function Block Library is at the heart of the Safety Matrix toolkit, because it executes the Safety Matrix Configuration Program logic. These blocks run in any ProSafe-PLC control module, such as the Critical Control Module (CCM) or Control Simulator.

As delivered, the blocks are empty cause and effects matrices possessing all of the program logic necessary to execute the matrix, log events to the SOE Viewer, and administer matrix security. Thus, matrix execution is automatic.

The Safety Matrix Operations and Maintenance Program communicates with a live controller or Control Simulator to execute a Safety Matrix function block. As such, the program consolidates real-time input data regarding all interlocks and provides dynamic, graphical visualization of one or more running matrices.

Users also access an existing matrix using the Program, and depending upon their security level may be granted the ability to apply maintenance bypasses, resets, and overrides. All such actions are automatically recorded in the SOER log. Besides the action itself, this log file records the date, time, user name, and reason, thereby providing comprehensive change history.

