

SNS 109000000-ST0001-R01

Human-Machine Interface (HMI) Standard

March 2003



A U.S. Department of Energy Multilaboratory Project

SPALLATION NEUTRON SOURCE
Argonne National Laboratory • Brookhaven National Laboratory • Thomas Jefferson National Accelerator Facility • Lawrence Berkeley National Laboratory • Los Alamos National Laboratory • Oak Ridge National Laboratory

SNS HUMAN-MACHINE (HMI) STANDARDS

March 2003

| | |
|---|------|
| Dave Gurd Senior Team Leader, Controls Group | Date |
|---|------|

| | |
|--|------|
| George Dodson SNS Accelerator Operations Group Leader | Date |
|--|------|

CONTENTS

| | |
|--|----|
| 1. INTRODUCTION | 3 |
| 2. SCREEN ELEMENTS | 3 |
| 2.1 Fonts..... | 3 |
| 2.1.1 Font Sizes..... | 3 |
| 2.1.2 Font Families..... | 4 |
| 2.2 Colors..... | 4 |
| 2.2.1 Color Map..... | 4 |
| 2.2.2 Color Schemes | 5 |
| 2.2.3 Color Rules | 14 |
| 2.3 Symbol Palettes..... | 14 |
| 2.4 Faceplates..... | 15 |
| 2.5 Version Control..... | 16 |
| 2.6 Environment Variables | 16 |
| 2.7 Alarm Status..... | 17 |
| 2.8 Graphic Rules..... | 18 |
| 2.9 Special Functions | 19 |
| 3. SCREEN LAYOUT | 19 |
| 3.1 Screen Hierarchy..... | 19 |
| 3.2 system Color Assignments..... | 20 |
| 3.3 Title..... | 20 |
| 3.4 Navigation..... | 21 |
| 3.5 Screen Parent / Child Relationships..... | 21 |
| APPENDIX A - Instructions For Use Of Faceplates..... | 22 |

SNS HUMAN-MACHINE INTERFACE (HMI) STANDARD

1. INTRODUCTION

This standard describes the visual standards to be used when designing SNS EPICS screens with the EDM display manager tool¹. The scope of this document includes: color, font, placement, inter-screen navigation, version management, and layout. Some aspects are entirely under control of the screen designer, whereas others require the use of shared “rules” files.

It should be noted that EDM is still under development, with modifications and extensions being made in response to the needs of the SNS project. Some of these changes may ultimately affect the implementation of this standard. Meanwhile, this version of the standard represents our consensus of the best approach for the version of EDM in hand².

Examples of various screens, tables, and rules files are kept on the host `ics-dev3.sns.gov`.

2. SCREEN ELEMENTS

2.1 FONTS

2.1.1 Font Sizes

EDM reads a file `font.list` to load Helvetica and Courier fonts for 22 font sizes. Font sizes can be specified independently of the widget box size by making a selection from a popup list in the widget properties dialog box. A choice can also be made of standard, bold, and italic styles. The current list is (in pixels):

8,10,12,14,16,18,20,24,28,32,36,42,48,60,72,96,120,168,216,312,408,504

The large sizes are intended for distant viewing of “key parameters” on widely dispersed “comfort displays.” A sample showing a range of selected sizes is available (see Fig. 2-1) in `fontTable.edl`.

¹ Documentation on the EDM display manager tool is available in the “.doc” directory of the EDM CVS tree.

² EDM Version 1.7 was in use at the time this was written.

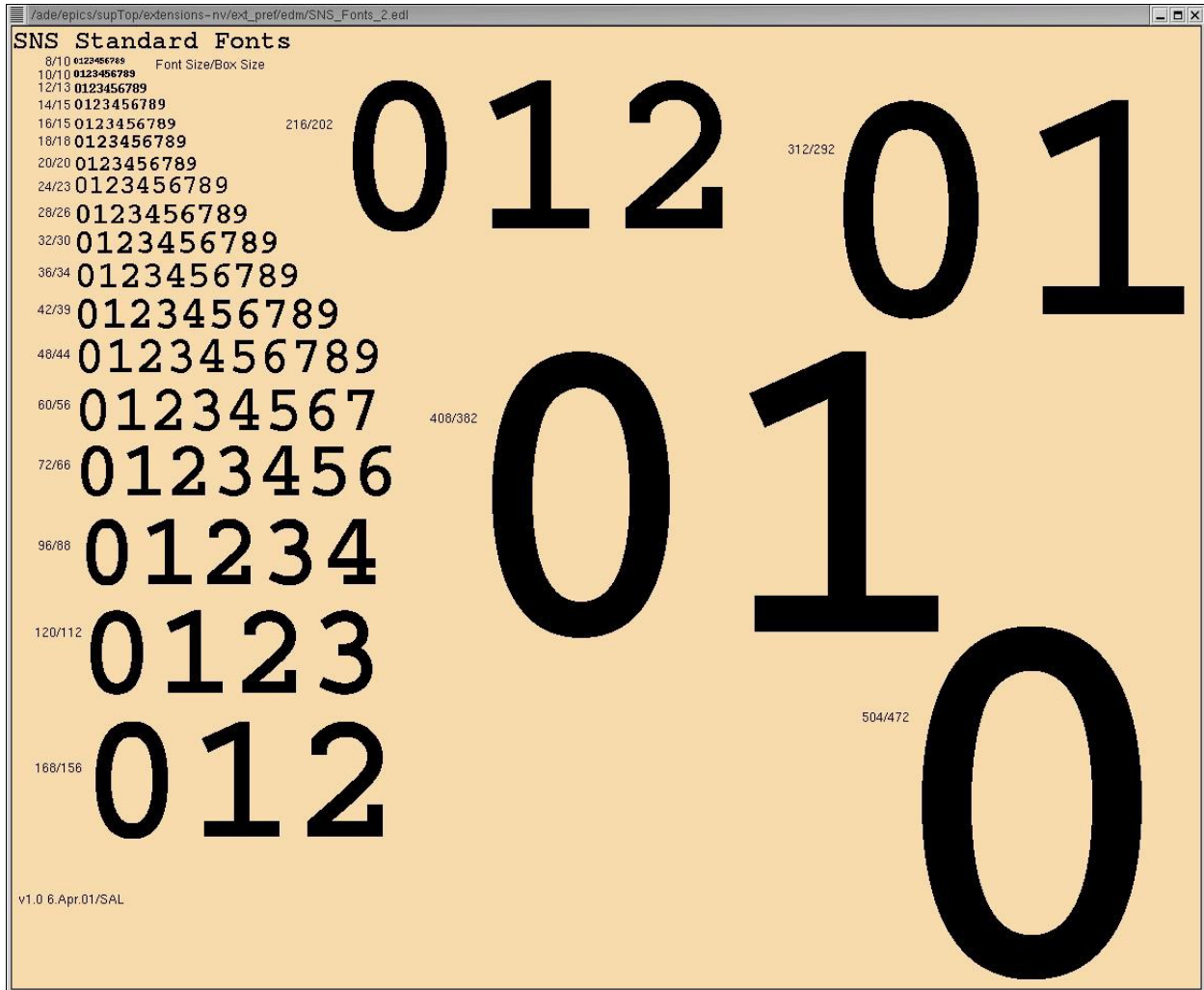


Figure 2-1: Standard Font Sizes

2.1.2 Font Families

Two fonts may be used:

- Courier. The Courier font is a fixed-width font generally available on the expected X-servers (Solaris, Linux, Windows + Exceed) and is generally used for “numeric readouts”. The fixed-width emulates a panel meter and keeps the text stable when values change. (See also *Environment* for additional invocation information.).
- Helvetica. The Helvetica font is a proportional font used for annotation and titling.

2.2 COLORS

2.2.1 Color Map

EDM does not have built-in color values; rather, it loads a default color table (80 colors) and a set of 28 color rules from the file `colors.list`. Each table entry is indexed. This helps to preserve a core set of definitions that provide for backward compatibility if the table is ever augmented. An annotated

display of the SNS standard colors is shown in Fig. 2-2a. A full color palette is shown in Fig. 2-2b and the corresponding color names list (partial view) is shown in Fig. 2-2c. Colors can be selected for use in the widget properties dialog box (see example of this for the Related Display widget in Fig. 2-2d.) either from the color palette or from the color names. Colors shown with dots in the center of the color square are used to indicate which colors in the palette are associated with color rules (see discussion in Color Rules section).

Table 2-1 lists the 14 major colors (shown in the lower left of the SNS standard colors screen of Fig. 2-2a) and their standard uses.

2.2.2 Color Schemes

Color schemes can be defined for subsets of colors that are used in collections of screens for particular systems (see the two top groups shown for the SNS Standard Colors in Fig. 2-2a) or groupings of widgets. Color scheme files can be saved using the middle mouse button popup menu selection for saving color schemes (either “default.scheme” or a .scheme file of whatever name the user chooses). The EDM documentation explains how to do this.

NOTE: Currently if a user wants to be able to create a color scheme, it is necessary to copy the files from the area defined by the \$EDMFILES path (see *Environment Variables* section below) into a directory for which the user has read/write privilege in order for the “Save Display Scheme...” menu selection to work. This is intended to be a temporary “work around.”

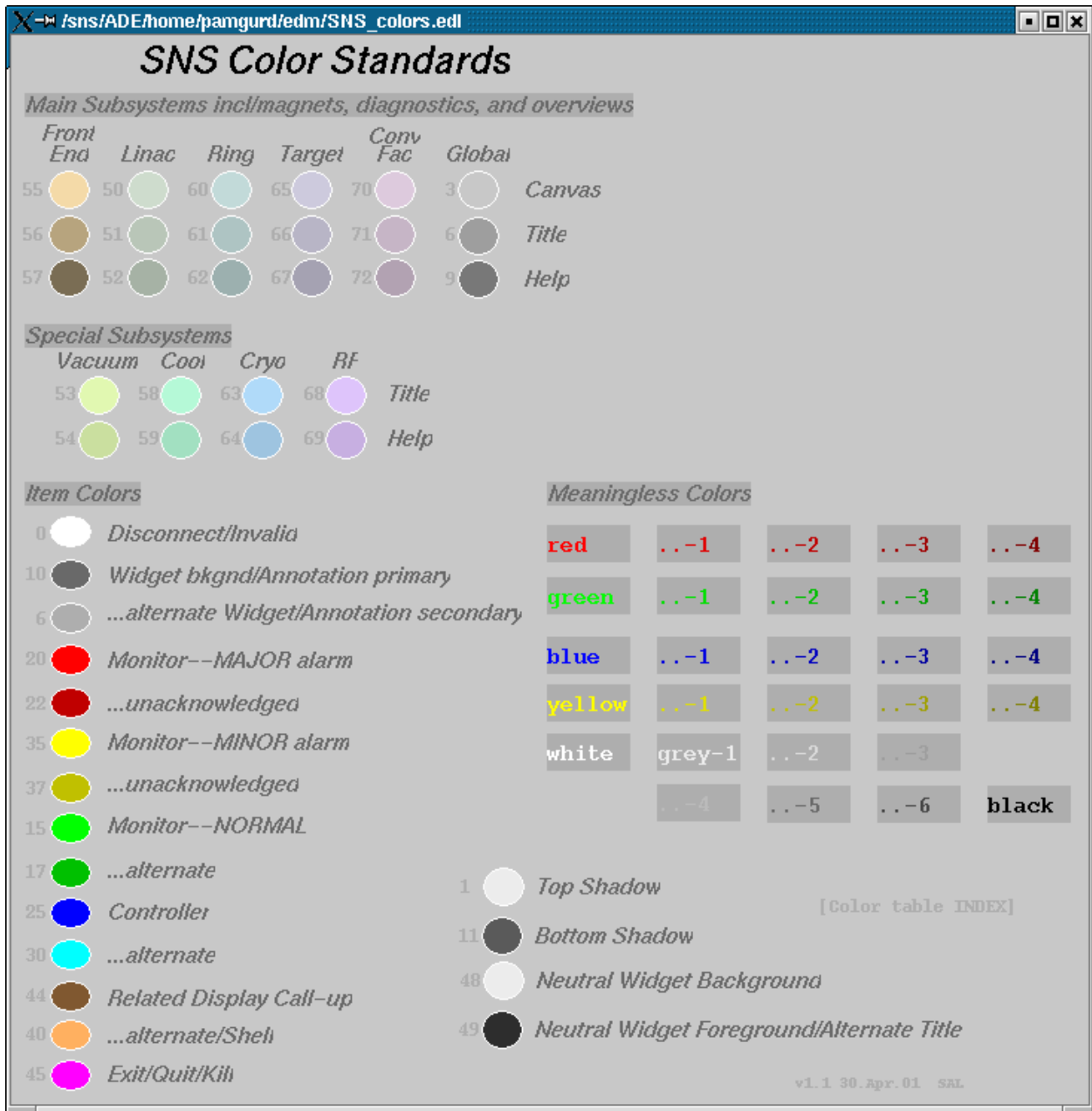


Figure 2-2a: SNS Standard Color Usage

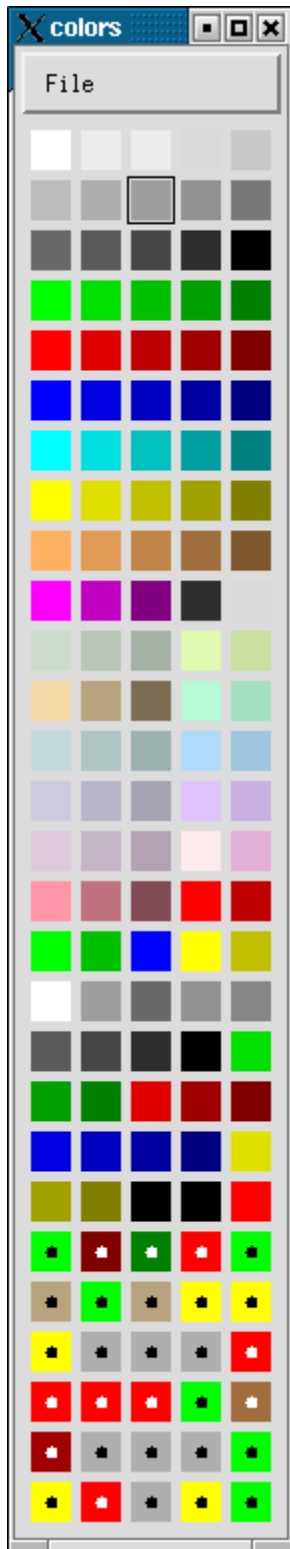


Figure 2-2b: SNS EDM Colors and Color Rules

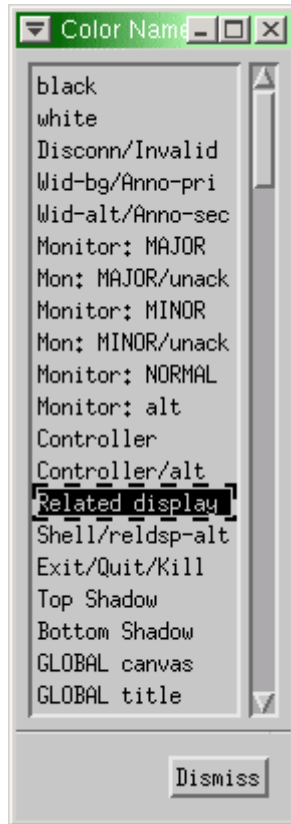


Figure 2-2c: SNS EDM Color Names

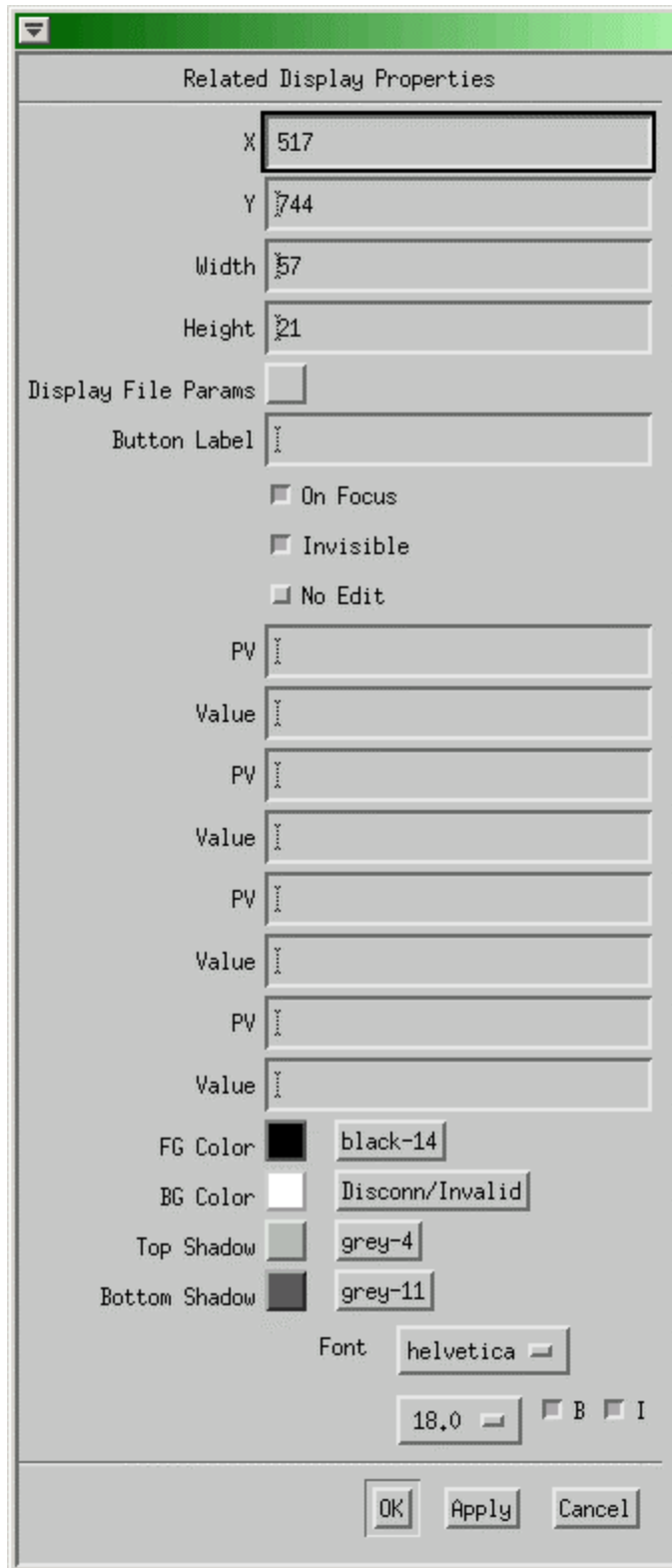


Figure 2-2d: EDM Related Display Properties Dialog Box

Table 2-1 – SNS Color Standard Usage

NOTE: The actual color values used for animating active devices (other than the standard EPICS Alarm Rule for monitored values) are not fixed, and therefore are not listed in this table. See “Color Rules” discussion later in this document. Panel-meter-style numeric displays refer to what are sometimes called “nixie tube” readouts and can be implemented using the TextUpdate Object.

| Index/Label (Color) | Used for: | Examples: |
|------------------------------------|--|---|
| 00/”Disconn/Invalid” (white) | EPICS alarm rule result = “INVALID” (for both monitor and control signals) | Communications lost to PLC or IOC monitoring/controlling this parameter; broken signal cable |
| | Screen title foreground | Screen title lettering |
| | Related-display call-up foreground | Related display button label |
| 10/”Wid-bg/Anno-pri” (dark-gray) | Background for monitor widgets | Background for digits displayed in “panel-meter-style” format; background for bar-charts and dial gages |
| | Annotation for primary (EPICS-visible) devices | Signal name labels; label for “LED-lamp-style” status display |
| | Outlines for major equipment | Piping, pump outlines, valve outlines, beamline outlines |
| 06/”Wid-alt/Anno-sec” (light-gray) | Background for control widgets | Background for on/off pushbuttons; background for sliders |
| | Annotation for secondary (non-interfaced) devices and infrastructure | Labels for groups of devices |
| | Outlines for secondary equipment or equipment groupings | Boxes surrounding groups of devices |
| 20/”Monitor: MAJOR” (red) | EPICS alarm rule result = “ALARM” (for a monitored value) | Panel-meter-style numeric value displayed in red when value exceeds alarm threshold. |
| | “On-state” of red LED | LED-lamp-style display turns red to indicate a fault |
| | Color representing “off” or “closed” for the default color rule for animating an active device. NOTE: This is just the default. Colors rules used to animate active devices are not fixed. See note at top of table. | Valve widget turns red to indicate “valve is closed”; pump widget turns red to indicate “pump is off”. |

| Index/Label (Color) | Used for: | Examples: |
|-------------------------------------|---|--|
| | Used by “write-permission-denied” symbol. | The classic “not” symbol of circle-with-slash is shown when mouse cursor passes over button operator is unauthorized to control. |
| 22/“Mon: MAJOR/unack” (dark-red) | EPICS alarm rule result = “Unacknowledged-ALARM” (monitor—not yet supported) | Panel-meter-style numeric value displayed in dark-red when value exceeds alarm threshold and alarm has not yet been acknowledged. |
| | “Off-state” of red LED. | LED-lamp-style display is dark red when there is no fault condition. |
| 35/“Monitor: MINOR” (yellow) | EPICS alarm rule result = “WARN” (monitor only) | Panel-meter-style numeric value displayed in yellow when value exceeds warning threshold |
| | “On-state” of yellow LED. | LED-lamp-style display turns yellow to indicate a “warning” condition |
| 37/“Mon: MINOR/unack” (dark-yellow) | EPICS alarm rule result = “Unacknowledged-WARN” (monitor only—not yet supported) | Panel-meter-style numeric value displayed in dark-yellow when value exceeds warning threshold and alarm has not yet been acknowledged. |
| | “Off-state” of yellow LED. | LED-lamp-style display is dark-yellow when no warning condition |
| 15/“Monitor: NORMAL” (green) | EPICS alarm rule result = “NORMAL” (monitor only). | Panel-meter-style numeric value displayed in green when value is in normal operating range. |
| | “On-state” of green LED | LED-lamp-style display turns green to show device is “on” |
| | Color representing “on” or “open” for the default color rule for animating an active device. NOTE: This is just the default. Colors rules used to animate active devices are not fixed. See note at top of table. | Valve widget turns green to indicate “valve is open”; pump widget turns green to indicate “pump is on”. |
| 17/“Monitor: alt” (dark-green) | Alternate EPICS monitor | Panel-meter-style numeric display of numeric value in normal operating range. You can use both green and dark green monitor colors if you desire to distinguish between “primary” and “secondary” process variables. |
| | “Off-state” of green LED | LED-lamp-style display is dark-green when device is “off” |
| 48/“wid-fg-neu” (Black) | 2 nd Alternate EPICS monitor | Neutral condition; used when no alarm limits or conditions are defined or the alarm is displayed by a rectangle around the text display. |

| Index/Label (Color) | Used for: | Examples: |
|------------------------------|--|--|
| | Alternate title text | Screen title lettering when white does not offer sufficient contrast. |
| 49/"wid-bg-neu" (Light gray) | 2 nd Alternate EPICS monitor background | Use with the neutral foreground "wid-fg-neu" above. |
| 25/"Controller" (blue) | EPICS control | Button labels; slider scale lettering |
| 30/"Controller/alt" (cyan) | Alternate EPICS control. | Button labels; slider scale lettering. You can use both blue and light-blue monitor colors if you desire to distinguish between "primary" and "secondary" control variables. |
| 44/"Related display" (brown) | Related display call-up (another EDM screen). | Background for display call-up button |
| 40/orange | External "shell" command (another EPICS tools or any other Unix function—browser, calculator, etc) | |
| | "Drag source" for non-PV text drop into diagnostics. | |
| 45/"Exit/Quit/Kill" (purple) | Exit/Quit of screen—not yet supported. | |

2.2.3 Color Rules

The actual color values used for animating active devices (other than the standard EPICS Alarm Rule for monitored values) **shall not** be encoded in any specific screen. Rather, the object should refer to an external color rule. All color rules are kept in one file, referred to at invocation by the relevant *Environment Variable* \$EDMFILES.

Each system shall name its rules using its official system code (from Table 1 of the *SNS Device and Signal Naming System Requirements Document*) as its prefix, followed by a short, descriptive text for the type of device. The rule name **shall not** include the actual colors: the policy for the actual colors is embedded in the rules. Names may not have embedded white space. Examples of the proper format follow:

```
FE-Gate-Vlv
CF-Sump-Pmp
```

The format of a color rule is one or more lines of the C-like statement format

```
rule "<name>" {
  >=<minimum> && <<maximum> : "<color-name>" # <comment>
}
```

where:

<name> is the rule name referred to in the object on the .adl

<comment> is explanatory text for this rule

<minimum> is the minimum value which selects this color

<maximum> is the maximum value which selects this color

<color-name> is the real color name text string from the list appearing in the EDM color list (see Fig. 2-3b).

Examples:

```
rule "Alarm" {
  >=-0.5 && <0.5 : "Monitor: NORMAL"
  >=0.5 && <1.5 : "Monitor: MINOR"
  >=1.5 && <=2.5 : "Monitor: MAJOR"
  >2.5 : "purple-47"
}
rule "FE-Vlv" {
  >=-0.5 && <0.5 : "Monitor: MINOR" # transition = 00
  >=0.5 && <1.5 : "FE help" # closed = 01
  >=1.5 && <2.5 : "Monitor: NORMAL" # open = 01
  >=2.5 && <3.5 : "Monitor: MAJOR" # fault = 11
}
```

2.3 SYMBOL PALETTES

The On-line menu selection of the Help button on the menu bar of the EDM tool main screen provides access to a collection of help files explaining how to use many EDM features. One of the selections is "Available Symbols." Choosing this button will cause a file "availableSymbols.edl" to be displayed. When building screens, a palette (EDM screen) of standard symbols can be constructed and saved as

“availableSymbols.edl.” It can then be referenced from the Help file button as needed. Alternatively, this screen could only be a menu selection to provide access to the collection of all symbol palettes used for a project.

At the time this was written, there was no single project-wide “available symbols” file in use. Some symbols being used by conventional facilities are shown in figure 2.3a. Symbols used for vacuum system screens should comply with the *ASD Vacuum Standards Handbook* (document no. 102020000-ST0001).

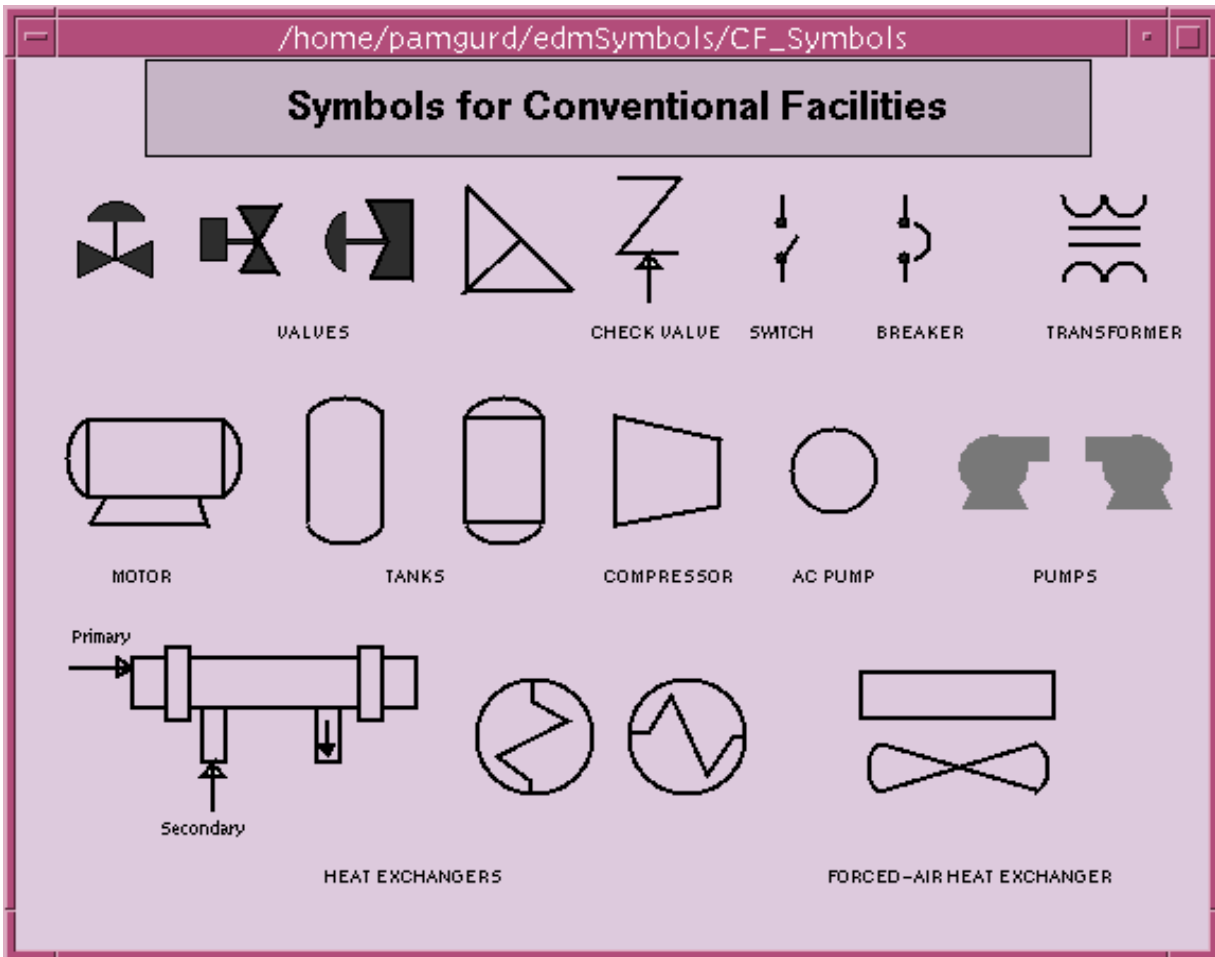


Figure 2.3a – Symbol Pallet Used by Conventional Facilities

2.4 FACEPLATES

Palettes of standard faceplates can also be created to speed up screen development. One such palette has been created for PID loops and is shown in Fig. 2-4. These faceplates can be called up as needed in pop-up mode to adjust setpoints, loop gains, etc., then dismissed, if there is insufficient room or no requirement for putting one permanently on a display screen. A set of instructions (see Appendix A) has been prepared describing how to implement a pop-up version.

Use of faceplates should be considered for any situation where different data are displayed in the same layout. The Related Display call-up can be hidden under a graphic element or displayed as a button with a label.

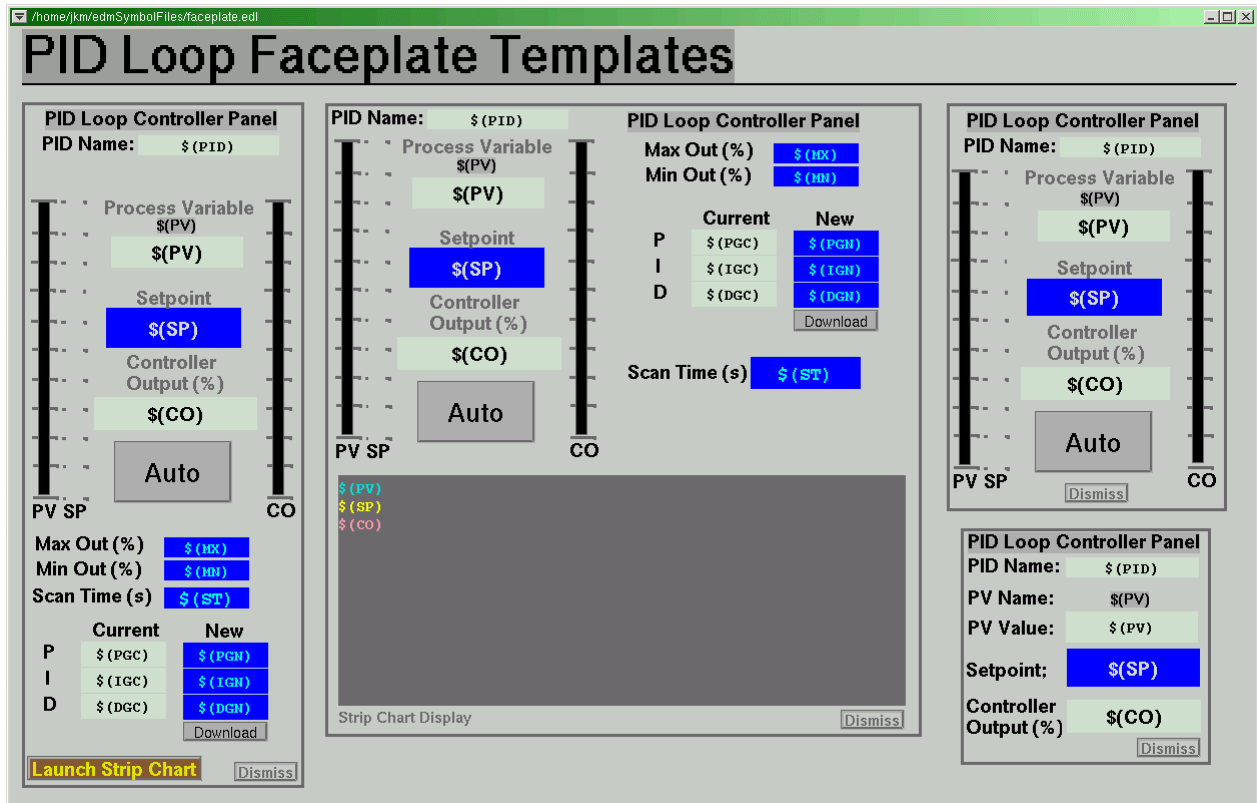


Fig. 2-4. PID Loop Faceplate Template Palette with Four Faceplates.

2.5 VERSION CONTROL

In order to make the screen files (.edl's) compatible with the SNS Application Development Environment (ADE), the text string \$Id\$ needs to appear at the beginning of these files. There are a couple of ways to do this:

- EDM allows for use of comments at the beginning of .edl files. So the string "\$Id\$" can be placed in a header in each .edl file for use by CVS/RCS to write version information.
- Alternatively, a *version item* can be placed on each screen at the extreme upper, right corner, consisting of a small (8x8-pixel) Related Display Call-up with the Visual attribute "invisible". Using \$Id\$ for the "Button Label" argument (see Fig 2-2d) will allow bringing up the current CVS/RCS expanded string in either edit-mode or run-mode.

[A more automatic approach to adding the required text string is planned for a future version of EDM.]

2.6 ENVIRONMENT VARIABLES

When invoked, EDM uses the following environment variables of the shell:

| Variable | Used for | Example |
|-----------------|--|--|
| EDMDATAFILES | Locations of .edl display files which are selectable from the Path drop-down menu on the main EDM screen menu bar. | ./:/ade/epics/iocTop/training/edmScreens |
| EDMFILES | Location of fonts.list and colors.list files. | /ade/epics/supTop/extensions/ext_pref/edm |
| EDMOBJECTS | Location of edmObjects, the EDM component object file. | /ade/epics/supTop/extensions/ext_pref/edm |
| EDMPVOBJECTS | Location of edmPvObjects, the EDM PV component object file. | /ade/epics/supTop/extensions/ext_pref/edm |
| EDMHLPFILES | Location of the help files. Help menu "On-line" opens helpMain.edl. | /ade/epics/supTop/extensions/src/edm/helpFiles |
| LD_LIBRARY_PATH | Search path for shared libraries | /usr/local/ivtools/lib:/ade/epics/supTop/extensions/lib/Linux:/ade/epics/supTop/base/R3.13.3/lib/Linux |

2.7 ALARM STATUS

On EDM screens there are three ways to indicate alarm conditions on text displays: by making the foreground characters change color, by changing the color of the background, or by changing the color of a rectangle around the text. Which of these implementations is used shall be a design decision. When the foreground characters are set up to change color, care is required to be sure the background color does not make it hard to read the displayed string. If the alarm rectangle is used, the neutral widget background/foreground colors should be used.

The EPICS Alarm Handler extension is a Tcl/Tk-based application for displaying alarm status information for a large number of process variables (PVs). These PVs can be grouped into a logical hierarchy and displayed in a tree structure, much like that used in the Windows Explorer directory and file browser tool. The EPICS Alarm Handler displays alarm status and severity information from EPICS records, generates and displays alarm history and log files, allows the operator to specify how alarms are to be filtered, and allows the operator to acknowledge alarms. It uses white, yellow, and red indicators to signal various alarm states. Extensive documentation is available which explains use of the Alarm Handler and how to configure it. Figure 2-7a through Fig. 2-7c show examples of some of the menus to give an idea of the capabilities of this tool.



Figure 2-7a. Alarm Handler View Menu

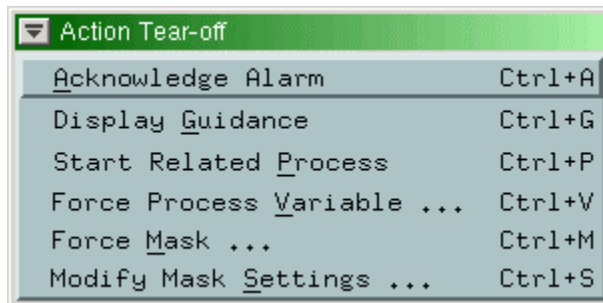


Figure 2-7b. Alarm Handler Action Menu

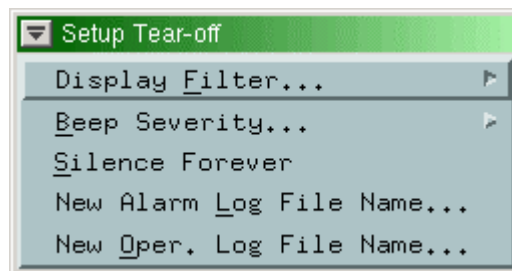


Figure 2-7c. Alarm Handler Setup Menu.

2.8 GRAPHIC RULES

When animation beyond simple color changes is desired, EDM has graphical dynamic symbols. A dynamic symbol is created by placing the individual dynamic “snap-shots” (small drawings) in a special EDM screen (a regular .edl file). Instructions for creating a dynamic symbol are available in help files accessible by choosing the “On-line” item in the Help menu.

The special screens holding the definitions of dynamic objects for each system shall be named using the official system code (from Table 1 of the *SNS Device and Signal Naming System Requirements Document*) as its prefix, followed by `-Dynamics.edl`. For example:

```
FE-Dynamics.edl
CF-Dynamics.edl
```

The different states of the dynamic symbol are drawn, then given an *Element Name*, which should be short and descriptive, but need not be unique outside of the overall `-Dynamics.edl` file for that system.

All graphical rules are specified in the symbol widget Properties dialog box by stepping through the symbol state number and entering the limits that apply to each state. Note that the first state is an “out-of-band” symbol.

The screen for `FE-Dynamics.edl` looks like:

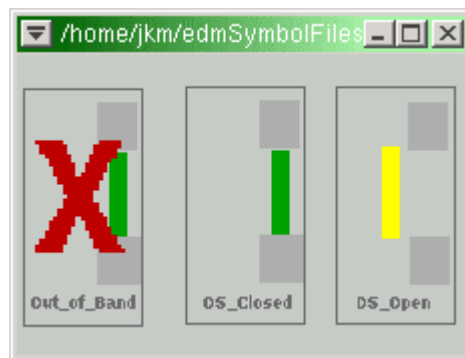


Figure 2-4: Example Screen Showing a Dynamic Symbol

2.9 SPECIAL FUNCTIONS

EDM supports an Exit/Quit/Close function using the Controls Exit Button widget. A window can be closed or the program exited (if the radio button “Exit Program” is selected in the Exit Button Properties dialog box) by clicking on an Exit/Quit/Close button placed the lower right corner of the screen.

3. SCREEN LAYOUT

3.1 SCREEN HIERARCHY

SNS screens will have five levels: SNS; Subsystem; Area; Device; Engineering/Debug. The top two are purely navigational; real operation takes place at the Area level (which is often a P&ID diagram). More details (suitable for detailed settings and options) appear at the Device level, but this level does not allow any functions that would be improper for an operator during typical start-up, running, and shut-down. The bottom level contains unusual features used only by engineers and technicians to test and fix problems; typically some functions at this level would place the devices out of normal range, and the EPICS access security mechanism should be employed to restrict usage.

3.2 SYSTEM COLOR ASSIGNMENTS

Colors should be used to indicate the system associated with the screen. System-specific colors are used for:

| Name | Comment |
|--------|--|
| Canvas | The ultimate background for that subsystem's text and widgets. |
| Title | Background for that subsystem's (white) <i>Title</i> lettering. |
| Help | Text intended for operator information, that is, not referring to any part of SNS physical structure.. |

Seven triads of colors are used to indicate system. In addition, six diads of colors are used for to indicate "special subsystems". The special subsystems use their own "Title" and "Help" area colors but use the canvas color for the system to which they belongs. The indices and color names assigned to these triads (and diads) are:

| Subsystem | Canvas | Title | Help |
|--------------------|------------------|-------------------|------------------|
| Front End | 55/FE canvas | 56/FE title | 57/FE help |
| Linac | 50/LINAC canvas | 51/LINAC title | 52/LINAC help |
| HEBT/Ring/ RTBT | 60/RING canvas | 61/RING title | 62/RING help |
| Target | 65/TARGET canvas | 66/TARGET title | 67/TARGET help |
| Conv Fac | 70/CF canvas | 71/CF title | 72/CF help |
| Global | 3/GLOBAL canvas | 6/GLOBAL title | 9/GLOBAL help |
| Vacuum | | 53/VAC title | 54/VAC help |
| Cool | | 58/COOL title | 59/COOL help |
| Cryogenics | | 63/CRYO title | 64/CRYO help |
| RF | | 68/RF title | 69/RF help |
| Diagnostics | | 73/DIAG title | 74/DIAG help |
| Controls | | 42/CONTROLS title | 43/CONTROLS help |

See figure 2-2a for "paint chips" showing these colors.

3.3 TITLE

Each screen shall have a title, consisting of black lettering on a TITLE-color rectangle placed at the extreme upper-left of the screen. In most cases the TITLE-color is light enough for the black lettering to show up more clearly than white. If the TITLE-color is too dark for black lettering to be clearly visible, then use white as the preferred alternative.

The preferred title area sizes for each screen level are:

| Level | Size |
|-------------|------|
| SNS | 60 |
| Subsytem | 48 |
| Area | 42 |
| Device | 32 |
| Engineering | 28 |

Choice of title size for the highest-level screen was a compromise between giving visibility across a large room and consuming scarce screen real estate. For lowest-level screens, font size

choice was made on the basis of legibility. The choice of black (default) or white lettering for titles needs to be made to provide legibility for different color choices for the title background. If a single font size were to be used, a good choice would be 42 and Helvetica Bold. These choices are also influenced by experience using display monitors with different dot-pitch values and different screen resolutions.

The width of the title is scaled to the length of the title text string if the “Autosize” feature is enabled for the Static Text graphic object. A horizontal line shall be placed at the lower edge of the title composite, of exactly the width of the screen. The space to the right of the title composite shall be the preferred location for related display call-ups for *Navigation*, e.g., for HELP buttons.

The font size used for the title can be linked to screen size or height of the rectangle used to provide the title background. The EDM Static Text graphic object has a background color property that can be used to generate a background rectangle that will then always be properly scaled for the choice of font size for title text when “Autosize” is enabled.

3.4 NAVIGATION

Each screen shall have suitable related display call-ups to allow, where appropriate, navigation “along the beam-line,” to the higher screen (which typically called this screen in), and other meaningful options. These shall be placed as far as practical in the area to the right of the Title, except that call-ups for lower-level (subsidiary) screens generally appear below the title-area line. An alternate location for navigation buttons (e.g., preferred for conventional facilities screens) is in a row along the bottom of the screen.

3.5 SCREEN PARENT / CHILD RELATIONSHIPS

Use (enable) the EDM “propagate” property to pass along local arguments to “child” screens. (Global parameter values are assigned using arguments provided at the time EDM is first executed).

@@@EDM has no provision currently to close a “parent” screen automatically when a “child” screen is selected for display. This means that on occasion high-level screens or screens with old (incorrect) values for parameters that are passed from “parent” to “child” can accumulate on the windows desktop and need to be closed or otherwise removed. From the main EDM screen menu bar, use View > Screens to obtain a list of screens that are open. This list can be checked for multiple instances of a screen, which then can be brought to the foreground and closed.

The EDM screen editor offers the option to close a “parent” screen automatically when a “child” screen is selected for display. If this option is not selected for some screens, then on occasion screens can accumulate on the windows desktop and need to be closed. From the main EDM screen menu bar, use View > Screens to obtain a list of screens that are open, which then can be brought to the foreground and closed. This list can also be checked for multiple instances of a screen.

Pressing the middle mouse button brings up a menu selection list that includes a “refresh” option.

APPENDIX A - INSTRUCTIONS FOR USE OF FACEPLATES

Figure A1 shows a faceplate template screen with four different PID loop faceplates. The two on the left allow the loop gains to be changed in addition to the PV setpoint. Faceplates on the right side allow only for changing the PV setpoint.

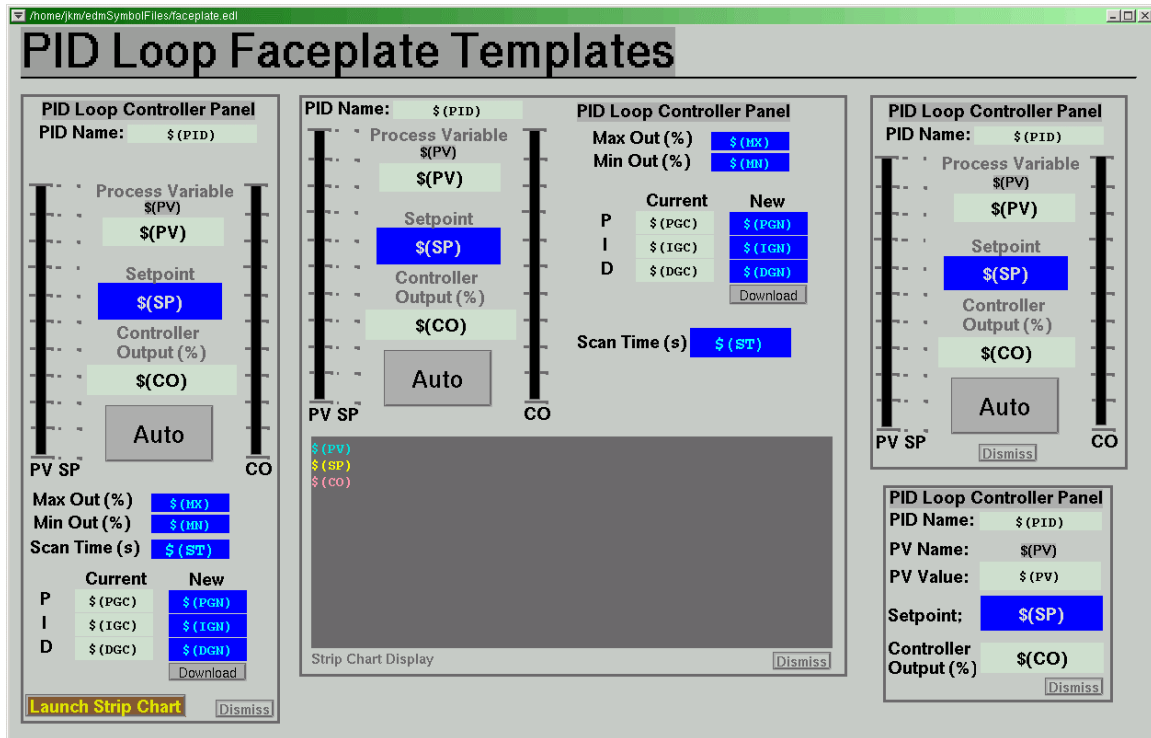


Figure A1. PID Loop Faceplate Template Palette with Four Faceplates.

One of these faceplates can be copied and pasted into a screen or can be “popped up” as needed using a Related Display widget with the appropriate widget properties selected. Process variable (PV) names for the faceplates on the palette are parameterized using the list of variables described below.

- PID: control loop name
- PV: process variable name
- SP: setpoint name
- CO: control output name
- PGC: proportional gain (current)
- IGC: integral gain (current)
- DGC: differential gain (current)
- PGN: proportional gain (new)
- IGN: integral gain (new)
- DGN: differential gain (new)
- MX: maximum output
- MN: minimum output
- ST: scan time (s)
- AM: Auto/Manual button

One of the Related Display widget properties is “Macros” where a list (comma delimited) of the variable “name=value” pairs must be supplied.

An example is described here for using a Related Display to pop up the faceplate shown in the upper right corner of the template screen in Fig. A1. The procedure is as follows:

1. Create an EDM screen containing only the faceplate using copy and paste operations to capture and transfer the faceplate from the palette screen to the pop-up screen. Give this screen a name using “Save As...”
2. Create a Related Display button, setting the following properties:
 - a. File: Name of the EDM screen containing the faceplate (created in previous step)
 - b. Macros: List of “name=value” pairs (See list below)
 - c. Propagate: Enabled
 - d. Set Position: Enabled
 - e. On Focus: Disabled (Enable if true pop-up is desired.)
 - f. Invisible: Enabled
3. Adjust the size of the Related Display button and hide it behind the PID control loop symbol.
4. Test operation of the Related Display.

“Name=Value” Pairs List (Demonstration Example)

```
PID=CF_DIWS:T2_PCV4000  
PV=CF_DIWS:T2_PT4000:P  
SP=CF_DIWS:T2_PCV4000:Set  
CO=CF_DIWS:T2_PCV4000:Psn
```