iRite®

Programming Manual

RICE LAKE®
WEIGHING SYSTEMS

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Contents

1.0 Introduction

iRite™ is a programming language developed by Rice Lake Weighing Systems to be used with a programmable indicator. Similar to other programming languages, *iRite* has a set of rules, called syntax, for composing instructions in a format that a compiler can understand.

This manual is intended for use by programmers who write *iRite* applications for digital weight indicators.

WARNING ***All programs should be thoroughly tested before implementation in a live system. To prevent personal injury and equipment damage, software-based interrupts must always be supplemented by emergency stop switches and other safety devices necessary for the application.***

Manuals can be viewed or downloaded from the Rice Lake Weighing Systems website at **www.ricelake.com/manuals**.

1.1 Overview

An *iRite* program is a text file, which contains statements composed following the *iRite* language syntax. The text file created using the *iRite* programming language must be compiled before use, this is done using a compiler program.

The compiler reads the text file and translates the program's intent into commands that are understandable to the indicators serial interface.

Other programming languages are often general and try to maximize flexibility in applications, therefore they have a lot of overhead and functionality that the programmer does not need.

With a variety of experienced operators that will be doing most of the *iRite* programming, there was a need for a language that was easy to learn and use for all programmers, but still familiar in syntax for the experienced programmer.

While creating the new language, the best features from other languages were used. The result is *iRite*: a compact language (only six discrete statement types, three data types) with a general syntax similar to Pascal and Ada, the string manipulation of Basic, and a rich set of function calls and built-in types specific to the weighing and batching industry.

1.2 iRite Programs

Each of the indicator tasks share processor time, but some tasks have higher priorities than others. If a low priority task is taking more than its share of processor time, it will be suspended so a higher priority task can be given processor time when it needs it. Then, when all the other higher priority tasks have completed, the low priority task will be resumed.

Gathering analog weight signals and converting it to weight data is the indicator's highest priority. Running a user-defined program has a very low priority. Streaming data out a serial port is the lowest priority task, because of its minimal computational requirements. This means that if the *iRite* program ***hangs***, the task of streaming out the serial ports will never get any CPU time and streaming will never happen. An example of interrupting a task would be if a user program included an event handler for ***SP1Trip*** (Setpoint 1 Trip Event) and this event ***fired***.

The logic for the SP1Trip event is executing at a given moment in time. In this example, the programmer wanted to display the message ***Setpoint 1 Tripped*** on the display. If the ***SP1Trip*** event logic doesn't complete by the time the indicator needs to calculate a new weight, the ***SP1Trip*** handler will be interrupted immediately, a new weight will be calculated, and the ***SP1Trip*** event will resume executing exactly where it was interrupted. In most circumstances, this happens so quickly the user will never know that the ***SP1Trip*** handler was ever interrupted.

Write and Compile iRite Programs

Templates and sample programs are available from Rice Lake Weighing Systems to provide the skeleton of a working program. With the *iRite* editor open, the program can be written. *iRite* source files are named with the *.src* extension.

In addition to writing *.src* files, an extension *.iri* can also be written to. The *iRite* language doesn't have the ability to include files, use iRev/Revolution to include the files. An included files can be helpful in keeping the *.src* program from getting cluttered with small unrelated functions and procedures that get used in many different programs. For example, create a file named *math.iri* and put only functions that perform some kind of math operation, not supported in the Revolution library already. When the program is compiled through Revolution, the *.iri* file is placed in Revolution where indicated. Because *iRite* enforces ***declaration before use***, the *.iri* file needs to be placed before any of the subprograms in the *.src* file.

When ready to compile the program, use the ***Compile*** feature from the ***Tools*** menu in the Revolution editor. If the program compiles without errors a new text file is created. This new text file has the same name but an extension of *.cod*. The new file named ***your_program.cod*** is a text file containing commands that can be sent to the indicator via a serial communication connection. Do not edit the *.cod* file.

Install the Program in the Indicator

The indicator must be in configuration mode before the ***.cod*** file can be sent. Use Revolution to send the *.cod* file to the indicator.

The *.cod* file can be sent directly from Revolution by using the ***Download Configuration...*** selection on the ***Communications*** menu and specifying to send the ***.cod*** file.

If the indicator is not in configuration mode, a pop-up message will appear in Revolution indicating it is not in configuration. It is recommended that Revolution or the Revolution Editor is used to send the compiled program to the indicator. This method implements error checking on each string sent to the indicator and helps protect from data transmission errors corrupting the program.

1.3 Running the iRite Program

A program written for an indicator is simply a collection of one or more custom event handlers and their supporting subprograms. A custom event handler is run whenever the associated event occurs. The ***ProgramStartup*** event is called whenever the indicator is powered up, is taken out of configuration mode, or is sent the RS serial command. It should be straightforward when the other event handlers are called.

*Example: the **DotKeyPressed** event handler is called whenever "." is pressed.*

All events have built-in intrinsic functionality associated with them, although, the intrinsic functionality may be to do nothing. If a custom event handler is written for an event, the custom event handler will be called instead of the intrinsic function, and the default action will be suppressed.

For example, the built-in intrinsic function of the **UNITS** key is to switch between primary, secondary, and tertiary units. If the handler ***UnitsKeyPressed*** was defined in a user program, then the **UNITS** key no longer switches between primary, secondary, and tertiary units, but instead does whatever is written in the handler ***UnitsKeyPressed***. The ability to turn off the custom event handler and return to the intrinsic functionality is provided by the ***DisableHandler*** function.

It is important to note that only one event handler can be running at a time. This means that if an event occurs while another event handler is running, the new event will not be serviced immediately but instead will be placed in a queue and serviced after the current event is done executing.

This means that if executing within an infinite loop in an event handler, then no other event handlers will ever get serviced. This doesn't mean that the indicator will be totally locked-up: The indicator will still be executing its other tasks, like calculating current weights, and running the setpoint engine. But it will not run any other custom event handlers while one event is executing in an infinite loop.

There are some fatal errors that an *iRite* program can make that will completely disable the indicator. Some of these errors are ***...divide by zero***, ***string space exhausted***, and ***array bounds violation***. When they occur, the indicator stops processing and displays a fatal error message on the display. Power must be cycled to reset the indicator.

After the indicator has been restarted, it should be put into setup mode, and a new version (without the fatal error) of the *iRite* program should be loaded. If a fatal error occurs in the ProgramStartup Handler, then cycling power to the unit will only cause the ProgramStartup Handler to be run again and repeat the fatal error.

In this case, perform a ***RESETCONFIGURATION***. The program, along with the configuration, will be erased and set to the defaults. This will allow the reload of the *iRite* program after the code that generated the fatal error has been corrected and the program re-compiled.

1.4 Sound Programming Practices

When writing source code remember that it has two important functions: it must work and and how it works must be clearly documented. With well documented source code, a high quality product is produced that will require minimal maintenance.

iRite source code may need to be reviewed over time, long after the original author has forgotten how the program worked or isn't around to ask. This is why programming is done to a specific standard. The template programs, example programs, and purchased custom programs that are available from Rice Lake Weighing Systems follow a single standard. This standard can be downloaded from the Rice Lake website, or a new standard can be written.

The purpose of a standard is to guide programmers while creating software, when a standard is followed the source code will be easy to follow and understand. A standard documents:

- The recommended style and form for modules, programs, and subprogram headers.
- Proper naming conventions for variables and functions.
- Guidelines for function size and purpose.
- Commenting guidelines and coding conventions.

2.0 Tutorial

The first program a programmer typically writes in every language is the “Hello World!” program. Once that has been accomplished, the basic components will be in place and the door will be open to the imagination to start writing real world solutions to some challenging tasks.

Below is the “Hello World!” program in *iRite*:

```
01   program HelloWorld;
02
03   begin
04     DisplayStatus("Hello, world!");
05   end HelloWorld;
```

This program will display the text “Hello World!” on the indicator’s display in the status message area, every time the indicator is turned on, taken out of configuration mode or reset. Below is a description of each line:

Line 01: `program HelloWorld;`

The first line is the program header. It consists of the keyword **program** followed by the name of the program. The name of the program is arbitrary and made up by the programmer. The program name; however, must follow the identifier naming rules (cannot start with a number or contain a space).

Line 02:

The second line is an optional blank line. Blank lines can be placed anywhere in the program to separate important lines and to make the program easier to read and understand.

Line 03: `begin`

The **begin** keyword is the start of the optional main code body. The optional main code body is actually the ProgramStartup event handler. The ProgramStartup handler is the only event handler that doesn’t have to be specifically named.

Line 04: `DisplayStatus("Hello, world!");`

The statement `DisplayStatus("Hello, world!")` is the only statement in the main code body. It is a call to the built-in procedure DisplayStatus with the string constant “Hello, world!” passed as a parameter. The result is the text, "Hello, world!" will be shown in the status area of the display (lower left corner), whenever the startup event is fired.

Line 05: `end HelloWorld;`

The keyword **end** followed by the same identifier for the program name used in line one, HelloWorld, is required to end the program.

Only the first and last lines are required, the program would compile, but it would do nothing. At a minimum, a working program must have at least one event handler, though it doesn’t have to be the ProgramStartup handler. We could have written the HelloWorld program to display “Hello, world!” whenever any key on the keypad was pressed. It would look like this:

```
01   program HelloWorld;
02
03     handler KeyPressed;
04     begin
05       DisplayStatus("Hello, world!");
06     end;
07
08   end HelloWorld;
```

In this version, the ***KeyPressed*** event handler is used to call the ***DisplayStatus*** procedure. The ***KeyPressed*** event will fire any time any key on the keypad is pressed. Notice that the ***begin*** keyword that started the main code body, and the ***DisplayStatus*** call have been removed and replaced with the four lines making up the ***KeyPressed*** event handler definition.

Using the Revolution editor, write the original version of the “Hello, world!” program on the system. After it has compiled the program successfully, download it to the indicator. Once the program has been downloaded and the indicator is put back in run mode, then the text ***Hello, world!*** should appear on the display.

2.1 Program Example with Constants and Variables

The “Hello, world!” program didn’t use any explicitly declared constants or variables (the string “Hello, world!” is actually a constant, but not explicitly declared). Most useful programs use many constants and variables. The following program will calculate the area of a circle for various length radii.

The program, named ***PrintCircleAreas***, is shown below.

```
01   program PrintCircleAreas;
02
03     -- Declare constants and aliases here.
04     g_ciPrinterPort : constant integer := 2;
05
06     -- Declare global variables here.
07     g_iCount : integer := 1;
08     g_rRadius : real;
09     g_rArea : real;
10     g_sPrintText: string;
11
12
13     function CircleArea(rRadius : real) : real;
14       crPie : constant real := 3.141592654;
15     begin
16       -- The area of a circle is defined by: area = pie*(r^2).
17       return (crPie * rRadius * rRadius);
18     end;
19
20
21   begin
22
23     for g_iCount := 1 to 10
24     loop
25
26       g_rRadius := g_iCount;
27       g_rArea := CircleArea(g_rRadius);
28
29       g_sPrintText := "The area of a circle with radius " + RealToString(g_rRadius, 4, 1)
30                            + " is " + RealToString(g_rArea, 7, 2);
31
32       WriteLn(g_ciPrinterPort, g_sPrintText);
33
34     end loop;
35
36   end PrintCircleAreas;
```

The PrintCircleAreas program demonstrates variables and constants as well as introducing these important ideas: **for** loop, assignment statement, function declarations, function calling and return parameters, string concatenation, WriteLn procedure, a naming convention, comments, and a couple of data conversion functions.

This program will calculate the areas of circles with radius from 1 to 10 (counting by 1s) and send text like, ***The area of a circle with radius 1 is 3.14***, once for each radius, out the communication port 2.

```
01   program PrintCircleAreas;
```

Line 01 is the program header with the keyword **program** and the program identifier ***PrintCircleAreas***. This is the same in theory as the ***HelloWorld*** program header.

Line 03 is a comment. In *iRite* all comments are started with a `--` (double dash). All text after the double dash up to the end of the line is considered a comment. Comments are used to communicate to any reader what is going on in the program on the specific lines with the comment or immediately following the comment. The `--` can start on any column in a line and can be after, on the same line, as other valid program statements.

Line 4 is a global constant declaration for the communication port that a printer may be connected to. This simple line has many important parts:

```
04   g_ciPrinterPort : constant integer := 2;
```

First, an identifier name is given. Identifier names are made up by the programmer and should accurately describe what the identifier is used for. In the name g_ciPrinterPort the “PrinterPort” part tells us that this identifier will hold the value of a port where a printer should be connected. The “g_ci” is a prefix used to describe the type of the identifier. When “g_ciPrinterPort” is used later on in the program, the prefix may help someone reading the program, even the program’s author, to easily determine the identifier’s data type without having to look back at the declaration.

The “g_” in the prefix helps tell us that the identifier is “global”. Global identifiers are declared outside of any subprogram (handler, function, procedure) and have global scope. The term “scope” refers to the region of the program text in which the identifier is known and understood. The term “global” means that the identifier is “visible” or “known” everywhere in the program. Global identifiers can be used within an event handler body, or any procedure or function body. Global identifiers also have “program duration”. The duration of an identifier refers to when or at what point in the program the identifier is understood, and when their memory is allocated and freed. Identifiers with global duration, in the indicator program, are understood in all text regions of the program, and their memory is allocated at program start-up and is re-allocated when the indicator is powered up.

The “c” in the prefix helps us recognize that the identifier is a constant. Constants are a special type of identifier that are initialized to a specific value in the declaration and may not be changed anytime or anywhere in the program. Constants are declared by adding the keyword **constant** before the type.

Constants are very useful and make the program more understandable. In this example, we defined the printer port as port 2. If we would have just used the number 2 in the call to WriteLn, then a reader of the program would not have any idea that the programmer intended a printer to be connected to the programmable indicator’s port 2.

Also, in a larger program, port 2 may be used hundreds of times in Write and WriteLn calls. Then, if it were decided to change the printer port from port 2 to port 3, hundreds of changes would have to be made. With port 2 being a constant, only one change in the declaration of g_ciPrinterPort would be required to change the printer port from 2 to 3.

The type of the constant is an integer. The “i” in the prefix helps us identify g_ciPrinterPort as an integer. The keyword **integer** follows the keyword **constant** and specifies the type compatibility of the identifier as an integer and also determines how much memory will be required to store the value (a value of 2 in this example). In the *iRite* programming language, there are only 3 basic data types: integer, real and string.

The initialization of the constant is accomplished with the “:= 2” part of the statement. Initialization of constants is done in the declaration, with the assignment operator, **:=**, followed by the initial value.

Finally, the statement is terminated by a semicolon. The “;” is used in *iRite* and other languages as a statement terminator and separator. Every *statement* must be terminated with a semicolon. Don’t read this to mean “every *line* must end in a semicolon”; this is not true. A statement may be written on one line, but it is usually easier to read if the statement is broken down into enough lines to make some keywords stand out and to keep the length of each line less than 80 characters.

Some statements contain one or more other statements. In our example, the statement:

```
g_ciPrinterPort : constant integer := 2;
```

is an example of a simple statement that easily fit on one line of code. The **`loop`** statement in the program startup handler (main code body) is spread out over several lines and contains many additional statements. It does, however, end with line **`end loop`**;, and ends in a semicolon.

```
06    -- Declare global variables here.
07    g_iCount : integer := 1;
08    g_rRadius : real;
09    g_rArea : real;
10    g_sPrintText: string;
```

Line 6 is another comment to let us know that the global variables are going to be declared.

Lines 7—10 are global variable declarations. One integer, g_iCounter, two reals, g_rRadius and g_rArea, and one string, g_sPrintText, are needed during the execution of this program. Like the constant g_ciPrinterPort, these identifiers are global in scope and duration; however, they are not constants. They may have an optional initial value assigned to them, but it is not required. Their value may be changed any time they are "in scope", they may be changed in every region of the program anytime the program is loaded in the indicator.

Lines 13—18 are our first look at a function declaration. A function is a subprogram that can be invoked (or called) by other subprograms. In the PrintCircleAreas program, the function CircleArea is invoked in the program startup event handler. The radius of a circle is passed into the function when it is invoked. In *iRite* there are three types of subprograms: functions, procedures, and handlers.

```
13     function CircleArea(rRadius : real) : real;
14       crPie : constant real := 3.141592654;
15     begin
16       -- The area of a circle is defined by: area = pie*(r^2).
17       return (crPie * rRadius * rRadius);
18     end;
```

On line 13, the function declaration starts with the keyword **function** followed by the function name. The function name is an identifier chosen by the programmer. We chose the name "CircleArea" for this function because the name tells us that we are going to return the area of a circle. Our function CircleArea has an optional formal arguments (or parameters) list. The formal argument list is enclosed in parenthesis, like this: `(rRadius : real)`. Our example has one argument, but functions and procedures may have zero or more.

Argument declarations must be separated by a semicolon. Each argument is declared just like any other variable declaration: starting with an identifier followed by a colon followed by the data type. The exception is that no initialization is allowed. Initialization wouldn't make sense, since a value is passed into the formal argument each time the function is called (invoked).

The rRadius parameters are passed by value. This means that the radius value in the call is copied in rRadius. If rRadius is changed, there is no effect on the value passed into the function. Unlike procedures, functions may return a value. Our function CircleArea returns the area of a circle. The area is a real number. The data type of the value returned is specified after the optional formal argument list. The type is separated with a colon, just like in other variable declarations, and terminated with a semicolon.

Up to this point in our program, we have only encountered global declarations. On line 14 we have a local declaration. A local declaration is made inside a subprogram and its scope and duration are limited. So the declaration: `crPie : constant real := 3.141592654;` on line 14 declares a constant real named crPie with a value of 3.141592654. The identifier crPie is only known—and only has meaning—inside the text body of the function CircleArea. The memory for crPie is initialized to the value 3.141592654 each time the function is called.

Line 15 contains the keyword **begin** and signals the start of the function code body. A function code body contains one or more statements.

Line 16 is a comment that explains what we are about to do in line 17. Comments are skipped over by the compiler, and are not considered part of the code. This doesn't mean they are not necessary; they are, but are not required by the compiler.

Every function must return a value. The value returned must be compatible with the return type declared on line 14. The keyword **return** followed by a value, is used to return a value and end execution of the function. The **return** statement is always the last statement a function runs before returning. A function may have more than one return statement, one in each conditional execution path; however, it is good programming practice to have only one return statement per function and use a temporary variable to hold the value of different possible return values.

The function code body, or statement lists, is terminated with the **end** keyword on line 18.

In this program we do all the work in the program startup handler. We start this unnamed handler with the **begin** keyword on line 21.

```
23     for g_iCount := 1 to 10
24     loop
25
26       g_rRadius := g_iCount;
27       g_rArea := CircleArea(g_rRadius);
28
```

```
29      g_sPrintText := "The area of a circle with radius " + RealToString(g_rRadius, 4, 1)
30                         + " is " + RealToString(g_rArea, 7, 2);
31
32       WriteLn(g_ciPrinterPort, g_sPrintText);
33
34     end loop;
```

On line 23 we see a **for** loop to start the first statement in the startup handler. In *iRite* there are two kinds of looping constructs. The **for** loop and the **while** loop. **For** loops are generally used when you want to repeat a section of code for a predetermined number of times. Since we want to calculate the area of 10 different circles, we chose to use a **for** loop.

For loops use an optional iteration clause that starts with the keyword **for** followed by the name of variable, followed by an assignment statement, followed by the keyword **to**, then an expression, and finally an optional step clause. Our example doesn't use a step clause, but instead uses the implicit step of 1. This means that lines 26 through 32 will be executed ten times. The first time g_iCount will have a value of 1, and during the last iteration, g_iCount will have a value of 10.

All looping constructs (the **for** and the **while**) start with the keyword **loop** and end with the keywords **end loop,** followed by a semicolon. In our example, **loop** is on line 24 and **end loop** is on line 34. In between these two, are found, the statements that make up the body of the loop.

Line 26 is an assignment of an integer data type into a real data type. This line is unnecessary and the assignment could have been made automatically if the integer g_iCount was passed into the function CircleArea directly on line 27, since CircleArea is expecting a real value. Calls to functions like CircleArea are usually done in an assignment statement if the functions return value need to be used later in the program. The return value of CircleArea (the area of a circle with radius g_rRadius) is stored in g_rArea.

The assignment on lines 29 and 30 uses two lines strictly for readability. This single assignment statement does quite a bit. We are trying to create a string of plain English text that will say: "`The area of a circle with radius xx.x is yyyy.yy`", where the radius value will be substituted for `xx.x` and the calculated area will be substituted for `yyyy.yy`. The global variable g_sPrintText is a string data type. The constants (or literals): "`The area of a circle with radius `" and "` is `" are also strings.

However, g_rRadius and g_iArea are real values. We had to use a function from the API to convert the real values to strings. The API function RealToString is passed a real and a width integer and a precision integer. The width parameter specifies the minimum length to reserve in the string for the value. The precision parameter specifies how many places to report to the right of the decimal place. To concatenate all the small strings into one string we use the string concatenation operator, "+".

Finally, we want to send the new string we made to a printer. The Write and WriteLn procedures from the API send text data to a specified port. Earlier in the program we decided the printer port will be stored in g_ciPrinterPort. So the WriteLn call on line 32 send the text stored in g_sPrintText, followed by a carriage return character, out port 2.

If we had a printer connected to port 2 on the programmable indicator, every time the program startup handler is fired, we would see the following printed output:

```
The area of a circle with radius  1.0 is    3.14
The area of a circle with radius  2.0 is   12.57
The area of a circle with radius  3.0 is   28.27
The area of a circle with radius  4.0 is   50.27
The area of a circle with radius  5.0 is   78.54
The area of a circle with radius  6.0 is  113.10
The area of a circle with radius  7.0 is  153.94
The area of a circle with radius  8.0 is  201.06
The area of a circle with radius  9.0 is  254.47
The area of a circle with radius 10.0 is  314.16
```

3.0 Language Syntax

3.1 Lexical Elements

3.1.1 Identifiers

An identifier is a sequence of letters, digits, and underscores. The first character of an identifier must be a letter or an underscore, and the length of an identifier cannot exceed 100 characters. Identifiers are not case-sensitive: “`HELLO`” and “`hello`” are both interpreted as “`HELLO`”.

Examples:

Valid identifiers:	`Variable12`	
	`_underscore`	
	`Std_Deviation`	
Not valid identifiers:	`9abc`	First character must be a letter or an underscore.
	`ABC DEF`	Space (blank) is not a valid character in an identifier.

Identifiers are used by the programmer to name programs, data types, constants, variables, and subprograms. They can be named anything as long as they follow the rules above and the identifiers are not already used as a keyword or as a built-in type or built-in function. Identifiers provide the name of an entity. Names are bound to program entities by declarations and provide a simple method of entity reference. For example, an integer variable iCounter (declared `iCounter : integer`) is referred to by the name iCounter.

3.1.2 Keywords

Keywords are special identifiers that are reserved by the language definition and can only be used as defined by the language. The keywords are listed below for reference purposes. More detail about the use of each keyword is provided later in this manual.

and	**array**	**begin**	**builtin**	**constant**	**database**
else	**elsif**	**end**	**exit**	**for**	**function**
handler	**if**	**integer**	**is**	**loop**	**mod**
not	**of**	**or**	**procedure**	**program**	**real**
record	**return**	**step**	**stored**	**string**	**then**
to	**type**	**var**	**while**		

3.1.3 Constants

Constants are tokens representing fixed numeric or character values and are a necessary and important part of writing code. Here we are referring to constants placed in the code when a value or string is known at the time of programming and will never change once the program is compiled. The compiler automatically figures out the data type for each constant.

Note ***Be careful not to confuse the constants in this discussion with identifiers declared with the keyword*** **constant***, although they may both be referred to as constants.*

The three types of constants are defined by the language as described in the following sections.

Integer Constants

An integer constant is a sequence of decimal digits. The value of an integer constant is limited to the range $0 \ldots 2^{31} - 1$. *Any values outside the allowed range are silently truncated.*

Any time a whole number is used in the text of the program, the compiler creates an integer constant.

Examples of situations where an integer constant is used:

```
iCount : integer := 25;
for iIndex := 1 to 3
sResultString := IntegerToString(12345,0);
sysResult := StartTimer(4);
```

Real Constants

A real constant is an integer constant immediately followed by a decimal point and another integer constant. Real constants conform to the requirements of IEEE-754 for double-precision floating point values. When the compiler sees a number in the format *n.n* then a real constant is created.

Using the value .56 would generate a compiler error. Instead compose real constants between –1 and +1 with a leading zero like this: 0.56 and –0.667.

Examples of situations where a real constant is used:

```
rLength := 9.25;
if rValue <= 0.004 then
sResultString := RealToString(98.765);
rLogResult := Log(345.67);
```

String Constants

A string constant is a sequence of printable characters delimited by quotation marks (double quotes, " "). The maximum length allowed for a string constant is 1000 characters, including the delimiters.

Examples of situations where a string constant (or string literal) is used:

```
sUserPrompt := "Please enter the maximum barrel weight:";
WriteLn(iPrinter, "Production Report (1st Shift));
if sUserEntry = "QUIT" then
  DisplayStatus("Thank You!");
```

3.1.4 Delimiters

Delimiters include all tokens other than identifiers and keywords, including the arithmetic operators listed below:

```
>=   <=   <>   :=   <>   =    +    –    *    /
.    ,    ;    :    (    )    [    ]    "
```

Below is a functional grouping of all of the delimiters in *iRite*.

Punctuation

Parentheses

() (open and close parentheses) group expressions, isolate conditional expressions, and indicate function parameters:

```
iFarenheit := ((9.0/5.0) * iCelcius) + 32;    -- enforce proper precedence
if (iVal >= 12)  and (iVal <= 34) or (iMaxVal > 200)   -- conditional expr.
EnableSP(5);  -- function parameters
```

Brackets

[ ] (open and close brackets) indicate single and multidimensional array subscripts:

```
type CheckerBoard is array [8, 8] of recSquare;
iThirdElement := aiValueArray[3];
```

Comma

The comma(,) separates the elements of a function argument list and elements of a multidimensional array:

```
type Matrix is array [4,8] of integer;
GetFilteredCount(iScale, iCounts);
```

Semicolon

The semicolon (;) is a statement terminator. Any legal *iRite* expression followed by a semicolon is interpreted as a statement.

Colon

The colon (:) is used to separate an identifier from its data type. The colon is also used in front of the equal sign (=) to make the assignment operator:

```
function GetAverageWeight(iScale : integer) : real;
iIndex : integer;
csCopyright : constant string := "2002 Rice Lake Weighing Systems";
```

Quotation Mark

Quotation marks ("") are used to signal the start and end of string constants:

```
if sCommand = "download data" then
  Write(iPCPort, "Data download in progress.  Please wait…");
```

Relational Operators

Greater than (>)

Greater than or equal to (>=)

Less than (<)

Less than or equal to (<=)

Equality Operators

Equal to (=)

Not equal to (<>)

The relational and equality operators are only used in an **if** expression. They may only be used between two objects of compatible type, and the resulting construct will be evaluated by the compiler to be either true or false;

```
if iPointsScored = 6 then
if iSpeed > 65 then
if rGPA <= 3.0 then
if sEntry <> "2" then
```

Note ***Be careful when using the equal to (=) operator with real data. Because of the way real data is stored and the amount of precision retained, it may not contain what would be expected.***

Example, given a real variable named rTolerance:

```
rTolerance := 10.0 / 3.0
…
if rTolerance * 3 = 10 then
  -- do something
end if;
```

Note ***The evaluation of the*** if ***statement will resolve to false. The real value assigned to rTolerance by the expression 10.0 / 3.0 will be a real value (3.333333) that, when multiplied by 3, is not quite equal to 10.***

Logical Operators

These are keywords and not delimiters. In *iRite* the logical operators are **and**, **or**, and **not.** They are named *logical and*, *logical or*, and *logical negation* respectively. They are only used in an **if** expression and can only be used with expressions or values that evaluate to true or false.

```
if (iSpeed > 55) and (not flgInterstate) or (strOfficer = "Cranky") then
   sDriverStatus := "Busted";
```

Arithmetic Operators

The arithmetic operators (+, – ,* , /, and mod) are used in expression to add, subtract, multiply, and divide integers and real values. Multiplication and division take precedence over addition and subtraction. A sequence of operations with equal precedence is evaluated from left to right.

The keyword mod is not a delimiter, but is included here because it is also an arithmetic operator. The modulus (or remainder) operator returns the remainder when operand 1 is divided by operand 2.

Example:

```
rResult : 7 mod 3;   -- rResult should equal 1
```

Note ***Both division (/) and mod operations can cause the fatal divide-by-zero error if the second operand is zero.***

When using the divide operator with integers, be careful of losing significant digits.

Example

If dividing a smaller integer by a larger integer then the result is an integer zero: 4/7 = 0. If planning to assign the result to a real like in the following example:

```
rSlope : real;
rSlope := 4/7;
```

rSlope will still equal 0, not 0.571428671 as might be expected. This is because the compiler does integer math when both operands are integers, and stores the result in a temporary integer. To make the previous statement work in *iRite*, one of the operands must be a real data type or one of the operands must evaluate to a real.

So write the assignment statement like:

```
rSlope := 4.0/7;
```

If dividing two integer variables, multiply one of the operands by 1.0 to force the compile to resolve the expression to a real:

```
rSlope : real;
iRise : integer := 4;
iRun : integer := 7;

rSlope := (iRise * 1.0) / iRun;
```

Now rSlope will equal 0.571428671.

Note *The plus sign (+) is also used as the string concatenation operator. The minus sign (–) is also used as a unary minus operator that has the result equal to the negative of its operand.*

Assignment Operator (:=)

The assignment operator is used to assign a value to a compatible program variable or to initialize a constant. The value on the left of the ":=" must be a modifiable value.

Invalid examples:

```
3 := 1 + 1;  -- not valid
ciMaxAge := 67; -- where ciMaxAge was declared with keyword constant
iInteger := "This is a string, not an integer!";  -- incompatible types
```

Structure Member Operator ("dot")

The "dot" (.) is used to access the name of a field of a record or database types.

3.2 Program Structure

A program is delimited by a program header and a matching end statement. The body of a program contains a declarations section, which may be empty, and an optional main code body. The declaration section and the main code body may not both be empty.

```
<program>:
  program IDENTIFIER ';'
    <decl-section>
    <optional-main-body>
  end IDENTIFIER ';'
  ;
<optional-main-body>:
    /* NULL */
  | begin <stmt-list>
  ;
```

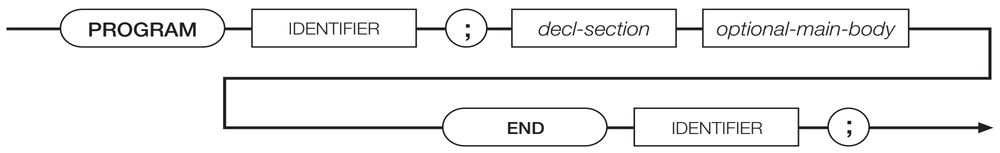


Figure 3-1. Program Statement Syntax

The declaration section contains declarations defining global program types, variables, and subprograms. The main code body, if present, is assumed to be the declaration of the program startup event handler. A program startup event is generated when the instrument personality enters operational mode at initial power-up and when exiting setup mode.

Example:

```
program MyProgram;
  KeyCounter : Integer;
  handler AnyKeyPressed;
    begin
      KeyCounter := KeyCounter + 1;
    end;

begin
  KeyCounter := 0
end MyProgram;
```

The *iRite* language requires declaration before use so the order of declarations in a program is very important. The declaration before use requirement is imposed to prevent recursion, which is difficult for the compiler to detect.

In general, it make sense for certain types of declarations to always come before others types of declarations. For example, functions and procedures must always be declared before the handlers. Handlers cannot be called or invoked from within the program, only by the event dispatching system. But functions and procedures can be called from within event handlers; therefore, always declare the functions and procedures before handlers.

Another example would be to always declare constants before type definitions. This way you can size an array with named constants.

Example program with a logical ordering for various elements:

```
program Template;   -- program name is always first!

-- Put include (.iri) files here.
#include template.iri

         -- Constants and aliases go here.
         g_csProgName : constant string := "Template Program";
         g_csVersion : constant string := "0.01";
         g_ciArraySize : integer := 100;

         -- User defined type definitions go here.
         type tShape is (Circle, Square, Triangle, Rectangle, Octagon, Pentagon, Dodecahedron);

         type tColor is (Blue, Red, Green, Yellow, Purple);

         type tDescription is
           record
             eColor : tColor;
             eShape : tShape;
           end record;

         type tBigArray is array [g_ciArraySize] of tDescription;


         -- Variable declarations go here.
         g_iBuild : integer;
         g_srcResult : SysCode;
         g_aArray : tBigArray;
         g_rSingleRecord : tDescription;

          -- Start functions and procedures definitions here.

          function MakeVersionString : string;
          sTemp : string;
        begin
          if g_iBuild > 9 then
            sTemp := ("Ver " + g_csVersion + "." + IntegerToString(g_iBuild, 2));
          else
            sTemp := ("Ver " + g_csVersion + ".0" + IntegerToString(g_iBuild, 1));
          end if;

          return sTemp;
         end;

         procedure DisplayVersion;
         begin
           DisplayStatus(g_csProgName + "  " + MakeVersionString);
         end;
    -- Begin event handler definitions here.
         handler User1KeyPressed;
         begin
           DisplayVersion;
         end;

-- This chunk of code is the system startup event handler.

begin

     -- Initialize all global variables here.
     -- Increment the build number every time you make a change to a new version.
     g_iBuild := 3;

     -- Display the version number to the display.
     DisplayVersion;

end Template;
```

3.3 Declarations

3.3.1 Type Declarations

Type declarations provide the mechanism for specifying the details of enumeration and aggregate types. The identifier representing the type name must be unique within the scope in which the type declaration appears. All user-defined types must be declared prior to being used.

```
     <type-declaration>:
          type IDENTIFIER is <type-definition> ';'
       ;
     <type-definition>:
          <record-type-definition>
        | <array-type-definition>
        | <database-type-definition>
        | <enum-type-definition>
        ;
```

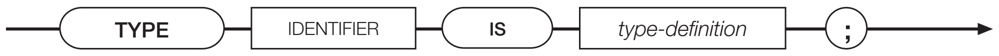


Figure 3-2. Type Declaration Syntax

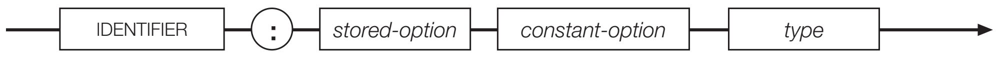


Figure 3-3. Identifier Syntax

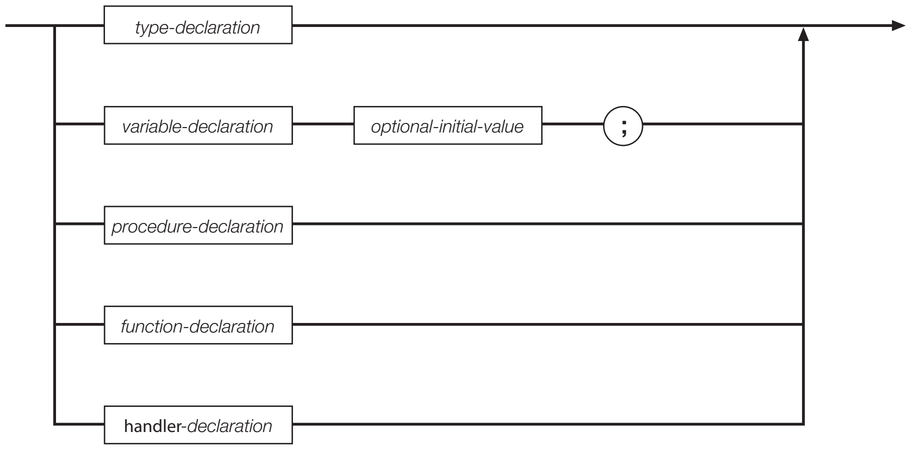


Figure 3-4. Type Declaration Syntax

Enumeration Type Definitions

An enumeration type definition defines a finite ordered set of values. Each value, represented by an identifier, must be unique within the scope in which the type definition appears.

```
<enum-type-definition>:
    '(' <identifier-list> ')'
  ;
<identifier-list>:
    IDENTIFIER
  | <identifier-list> ',' IDENTIFIER
  ;
```

Examples:

```
type StopLightColors is (Green, Yellow, Red);

type BatchStates is (NotStarted, OpenFeedGate, CloseGate, WaitforSS, PrintTicket, AllDone);
```

Record Type Definitions

A record type definition describes the structure and layout of a record type. Each field declaration describes a named component of the record type. Each component name must be unique within the scope of the record; no two components can have the same name. Enumeration, record and array type definitions are not allowed as the type of a component: only previously defined user- or system-defined type names are allowed.

```
<record-type-definition>:
    record
      <field-declaration-list>
    end record
  ;
<field-declaration-list>:
    <field-declaration>
  | <field declaration-list>
    <field declaration>
  ;
<field-declaration>:
      IDENTIFIER ':' <type> ';'
  ;
```

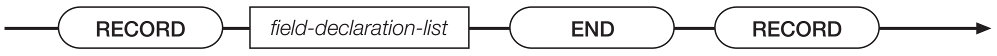


Figure 3-5. Record Type Definition Syntax

Examples:

```
type MyRecord is
  record
    A : integer;
    B : real;
  end record;
```

The EmployeeRecord record type definition, below, incorporates two enumeration type definitions, tDepartment and tEmptype:

```
type tDepartment is (Shipping, Sales, Engineering, Management);

type tEmptype is (Hourly, Salaried);

type EmployeeRecord is
  record
    ID : integer;
    Last : string;
    First : string;
    Dept : tDepartment;
    EmployeeType : tEmptype;
  end record;
```

Database Type Definitions

A database type definition describes a database structure, including an alias used to reference the database.

```
<database-type-definition>:
    database (STRING_CONSTANT)
      <field-declaration-list>
    end database
  ;
<field-declaration-list>:
    <field-declaration>
  | <field declaration-list>
    <field declaration>
  ;
<field-declaration>:
      IDENTIFIER ':' <type> ';'
  ;
```

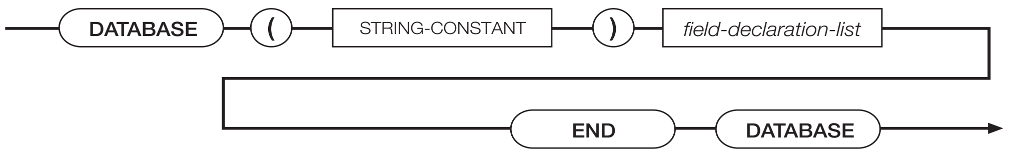


Figure 3-6. Database Type Definition Syntax

Example: A database consisting of two fields, an integer field and a real number, could be defined as follows:

```
type MyDB is
  database ("DBALIAS")
    A : integer
    B : real
  end database;
;
```

Array Type Definitions

An array type definition describes a container for an ordered collection of identically typed objects. The container is organized as an array of one or more dimensions. All dimensions begin at index 1.

```
<array-type-definition>:
    array '[' <expr-list> ']' of <type>
  ;
```

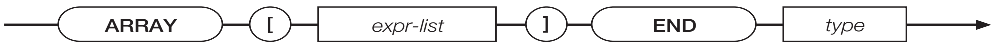


Figure 3-7. Array Type Definition Syntax

Examples:

```
type Weights is array [25] of Real;
```

An array consisting of user-defined records could be defined as follows:

```
type Employees is array [100] of EmployeeRecord;
```

A two-dimensional array in which each dimension has an index range of 10 (1…10), for a total of 100 elements could be defined as follows:

```
type MyArray is array [10,10] of Integer;
```

Note ***In all of the preceding examples, no variables (objects) are created, no memory is allocated by the type definitions. The type definition only defines a type for use in a later variable declaration, at which time memory is allocated.***

3.3.2 Variable Declarations

A variable declaration creates an object of a particular type. The type specified must be a previously defined user- or system-defined type name. The initial value, if specified, must be type-compatible with the declared object type. All user-defined variables must be declared before being used.

Variables declared with the keyword ***stored*** cause memory to be allocated in battery-backed RAM. Stored data values are retained even after the indicator is powered down.

Variables declared with the keyword ***constant*** must have an initial value.

```
<variable-declaration>:
    IDENTIFIER ':' <stored-option> <constant-option> <type>
    <optional-initial-value>
  ;
<stored-option>:
    /* NULL */
  | stored
  ;
<constant-option>:
    /* NULL */
  | constant
  ;
<optional-initial-value>:
    /* NULL */
  | := <expr>
  ;
```

Example:

```
MyVariable : StopLightColor; -- Declare MyVariable
MyCount : stored Integer; --Declare a stored variable of type Integer
```

3.3.3 Subprogram Declarations

A subprogram declaration defines the formal parameters, return type, local types and variables, and the executable code of a subprogram. Subprograms include handlers, procedures, and functions.

Handler Declarations

A handler declaration defines a subprogram that is to be installed as an event handler. An event handler does not permit parameters or a return type, and can only be invoked by the event dispatching system.

```
<handler-declaration>:
    handler IDENTIFIER ';'
      <decl-section>
    begin
      <stmt-list>
    end ';'
  ;
```

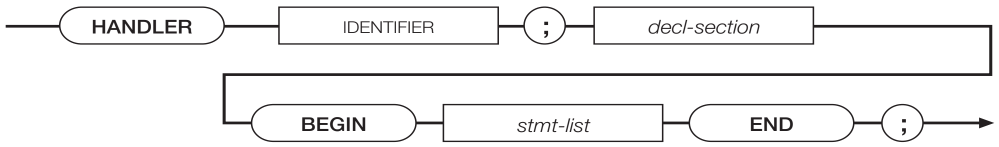


Figure 3-8. Handler Declaration Syntax

Example:

```
handler SP1Trip;

I : Integer;

begin
  for I := 1 to 10
  loop
    Writeln (1, "Setpoint Tripped!");
    if I=2 then
      return;
    endif;
  end loop;
end;
```

Procedure Declarations

A procedure declaration defines a subprogram that can be invoked by other subprograms. A procedure allows parameters but not a return type. A procedure must be declared before it can be referenced; recursion is not supported.

```
<procedure-declaration>:
    procedure IDENTIFIER
    <optional-formal-args> ';'
    <decl-section>
    begin
    <stmt-list>
    end ';'
  ;
<optional-formal-args>:
    /* NULL */
  | <formal-args>
  ;
<formal-args>:
    '(' <arg-list> ')'
  ;
<arg-list>:
    <optional-var-spec>
    <variable-declaration>
  | <arg-list> ';' <optional-var-spec>
```

```
        <variable-declaration>
      ;
    <optional-var-spec>:
        /* NULL */
      | var
      ;
```

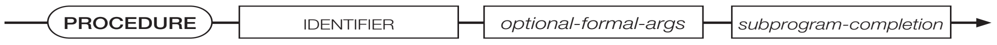


Figure 3-9. Procedure Declaration Syntax

Examples:

```
      procedure PrintString (S : String);
      begin
        Writeln (1, "The String is => ",S);
      end;

      procedure ShowVersion;
      begin
        DisplayStatus ("Version 1.42");
      end;

      procedure Inc (var iVariable : Integer);
      begin
        iVariable := iVariable + 1;
      end;
```

Function Declarations

A function declaration defines a subprogram that can be invoked by other subprograms. A function allows parameters and requires a return type. A function must be declared before it can be referenced; recursion is not supported. A function must return to the point of call using a return-with-value statement.

```
    <function-declaration>:
        function IDENTIFIER
        <optional-formal-args> ':' <type> ';'
        <decl-section>
        begin
        <stmt-list>
        end ';'
      ;
```

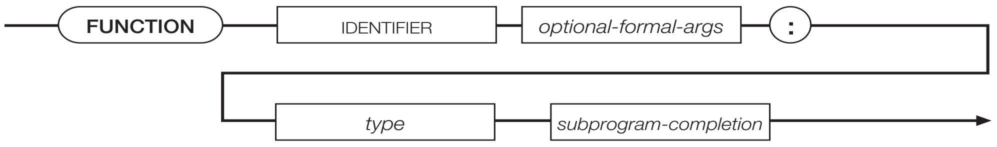


Figure 3-10. Function Declaration Syntax

Examples:

```
        function Sum (A : integer; B : integer) : Integer;
        begin
          return A + B;
        end;

        function PoundsPerGallon : Real;
        begin
          return 8.34;
        end;
```

3.4 Statements

There are only six discrete statements in *iRite*. Some statements, like the ***if***, ***call***, and assignment (:=) are used extensively even in the simplest program, while the ***exit*** statement should be used rarely. The ***if*** and the ***loop*** statements have variations and can be quite complex.

```
<stmt>:
      <assign-stmt>
    | <call-stmt>
    | <if-stmt>
    | <return-stmt>
    | <loop-stmt>
    | exit-stmt>
    ;
```

3.4.1 Assignment Statement

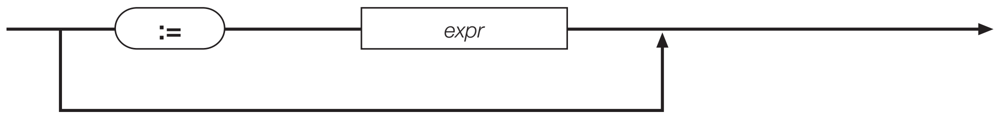


Figure 3-11. Assignment Statement Syntax

The assignment statement uses the assignment operator (:=) to assign the expression on the right-hand side to the object or component on the left-hand side. The types of the left-hand and right-hand sides must be compatible. The value on the left of the “:=” must be a modifiable value.

Examples:

Simple assignments:

```
iMaxPieces := 12000;
rRotations := 25.3456;
sPlaceChickenPrompt := "Please place the chicken on the scale…";
```

Assignments in declarations (initialization):

```
iRevision : integer := 1;
rPricePerPound : real := 4.99;
csProgramName : constant string := "Pig and Chicken Weigher";
```

Assignments in **for** loop initialization:

```
for iCounter := 1 to 25
for iTries := ciFirstTry to ciMaxTries
```

Assignment of function return value:

```
sysReturn := GetSPTime(4, dtDateTime);
rCosine := Cos(1.234);
```

Assignment with complex expression on right-hand side:

```
iTotalLivestock := iNumChickens + iNumPigs + GetNumCows;
rTotalCost := ((iNumBolt * rBoltPrice) + (iNumNuts * rNutPrice)) * (1 + rTaxRate);
sOutputText := The total cost is : " + RealToString(rTotalCost, 4, 2) + " dollars.";
```

Assignment of different but compatible types:

```
iValue := 34.867; -- Loss of significant digits! iValue will equal 34, no rounding!
rDegrees := 212; -- No problem! rDegrees will equal 212.000000000000000000
```

3.4.2 Call Statement

The call statement is used to initiate a subprogram invocation. The number and type of any actual parameters are compared against the number and type of the formal parameters that were defined in the subprogram declaration. The number of parameters must match exactly. The types of the actual and formal parameters must also be compatible. Parameter passing is accomplished by copy-in, or by copy-in/copy-out for ***var*** parameters.

```
     <call-stmt>:
          <name> ';'
     ;
```

Copy-in refers to the way value parameters are copied into their corresponding formal parameters. The default way to pass a parameter in *iRite* is by value, which means that a copy of the actual parameter is made to use in the function or procedure. The copy may be changed inside the function or procedure but these changes will never affect the value of the actual parameter outside of the function or procedure, since only the copy may be changed.

The other way to pass a parameter is to use a copy-in/copy-out method. To specify this method, a formal parameter must be preceded by the keyword ***var*** (variable) in the subprogram declaration. This means the parameter may be changed. Just like with a ***value*** parameter, a copy is made. When the function or procedure is done executing, the value of the copy is then copied, or assigned, back into the actual parameter. This is the copy-out part. The result is that if the formal ***var*** parameter was changed within the subprogram, then the actual parameter will also be changed after the subprogram returns. Actual ***var*** parameters must be values: a constant cannot be passed as a ***var*** parameter.

A potential issue occurs when passing a global parameter as a ***var*** parameter. If a global parameter is passed to a function or procedure as a ***var*** parameter, then the system makes a copy of it to use in the function body. If the value of the formal parameter is changed and some other function or procedure call is made after the change to the formal parameter, the function or procedure called uses, by name, the same global parameter that was passed into the original function. Then the value of the global parameter in the second function will be the value of the global when it was pass into the original function. This is because the changes made to the formal parameter (only a copy of the actual parameter passed in) have not yet been copied-out, since the function or procedure has not returned yet.

Example:

```
program GlobalAsVar;

g_ciPrinterPort : constant integer := 2;

g_sString : string := "Initialized, not changed yet";

  procedure PrintGlobalString;
  begin
    WriteLn(g_ciPrinterPort, g_sString);
  end;


  procedure SetGlobalString (var vsStringCopy : string);
  begin

    vsStringCopy := "String has been changed";

    Write(g_ciPrinterPort, "In function call: ");
    PrintGlobalString;

  end;
begin
  Write(g_ciPrinterPort, "Before function call: ");
  PrintGlobalString;

  SetGlobalString(g_sString);

  Write(g_ciPrinterPort, "After function call: ");
  PrintGlobalString;

end GlobalAsVar;
```

When run, the program prints the following:

```
Before function call: Initialized, not changed yet
In function call: Initialized, not changed yet
After function call: String has been changed
```

3.4.3 If Statement

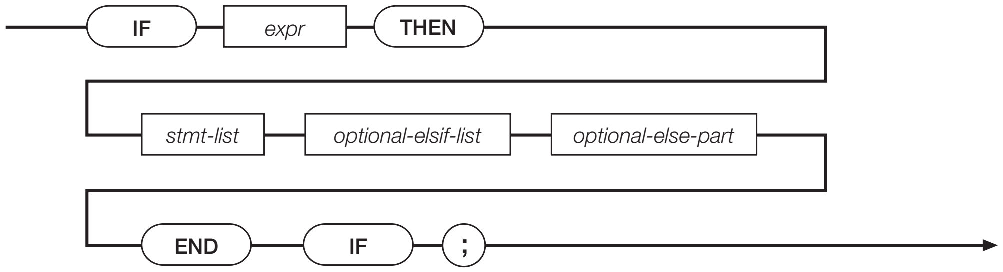


Figure 3-12. If Statement Syntax

The ***if*** statement is one of the programmer's most useful tools. The ***if*** statement is used to force the program to execute different paths based on a decision. In its simplest form, the ***if*** statement looks like this:

```
if <expression> then
  <statement list>
end if;
```

The decision is made after evaluating the expression. The expression is most often a conditional expression. If the expression evaluates to true, then the statements in <*statement list*> are executed. This form of the ***if*** statement is used primarily to only do something if a certain condition is true.

Example:

```
if iStrikes = 3 then
  sResponse := "You're out!";
end if;
```

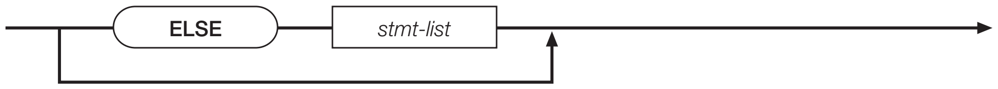


Figure 3-13. Optional Else Statement Syntax

Another form of the ***if*** statement, known as the ***if-else*** statement has the general form:

```
if <expression> then
  <statement list 1>
else
  <statement list 2>
end if;
```

The ***if-else*** is used when the program must decide which of exactly two different paths of execution must be executed. The path that will execute the statement or statements in <*statement list 1*> will be chosen if <*expression*> evaluates to true.

Example:

```
if iAge => 18 then
  sStatus := "Adult";
else
  sStatus := "Minor";
  end if;
```

If the statement is false, then the statement or statements in *<statement list 2>* will be executed. Once the expression is evaluated and one of the paths is chosen, the expression is not evaluated again. This means the statement will terminate after one of the paths has been executed.

Example:

*If the expression was true and we were executing <statement list 1>, and within the code in <statement list 1> we change some part of <expression> so it would at that moment evaluate to false, <statement list 2> would still not be executed. This point is more relevant in the next form called the **if-elsif**.*

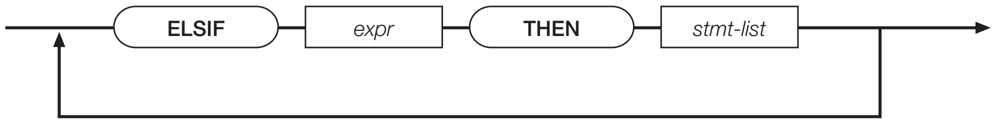


Figure 3-14. Optional Else-If Statement Syntax

The **if-elsif** version is used when a multi-way decision is necessary and has this general form:

```
if <expression> then
  <statement list 1>
elsif <expression> then
  <statement list 2>
elsif <expression> then
  <statement list 3>
elsif <expression> then
  <statement list 4>
else
  <statement list 5>
end if;
```

Example:

```
if rWeight <= 2.0 then
  iGrade := 1;
elsif (rWeight > 2.0) and (rWeight < 4.5) then
  iGrade := 2;
elsif (rWeight > 4.5) and (rWeight < 9.25) then
  iGrade := 3;
elsif (rWeight > 9.25) and (rWeight < 11.875) then
  iGrade := 4;
else
  iGrade := 0;
  sErrorString := "Invalid Weight!";
end if;
```

3.4.4 Loop Statement

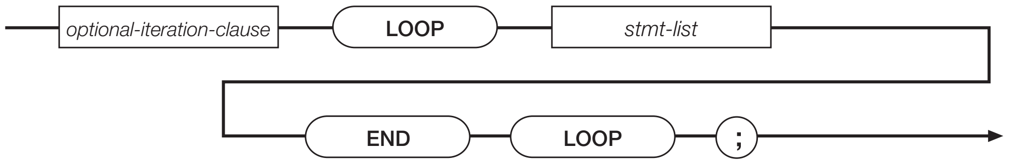


Figure 3-15. Loop Statement Syntax

The ***loop*** statement is used to execute a statement list 0 or more times. An optional expression is evaluated and the statement list is executed. The expression is then re-evaluated and as long as the expression is true the statements will continue to get executed. The ***loop*** statement in *iRite* has three general forms. One way is to write a loop with no conditional expression. The loop will keep executing the loop body (the statement list) until the ***exit*** statement is encountered. The ***exit*** statement can be used in any ***loop***, but is most often used in this version without a conditional expression to evaluate. It has this form:

```
loop
<statement list>
end loop;
```

This version is most often used with an ***if*** statement at the end of the statement list. This way the statement list will always execute at least once. This is referred to as a ***loop-until***.

Example:

```
rGrossWeight : real;

loop
  WriteLn(2, "I'm in a loop.");
  GetGross(1, Primary, rGrossWeight);
  if rGrossWeight > 200 then
    exit;
  end if;
end loop;
```

A similar version uses an optional ***while*** clause at the start of the loop. The ***while-loop*** version is used when the loop is to execute zero or more times. Since the expression is evaluated before the loop is entered, the statement list may not get executed even once. Here is the general form for the ***while-loop*** statement:

```
while <expression>
loop
  <statement list>
end loop;
```

*Example from above, but with a **while** clause. Keep in mind that if the gross weight is greater than 200 pounds, then the loop body will never execute:*

```
rGrossWeight : real;

GetGross(1, Primary, rGrossWeight);

while rGrossWeight <= 200
loop
    WriteLn(2, "I'm in a loop.");
    GetGross(1, Primary, rGrossWeight);
end loop;
```

*The weight must be known before we could evaluate the expression. In addition we have to get the weight in the loop. In this example, it would be better programming to use the **loop-until** version.*

Another version is known as the ***for-loop***. The ***for-loop*** is best used when you want to execute a chunk of code for a known or predetermined number of times. In its general form the ***for-loop*** looks like this:

```
for <name> := <expression> to <expression> step <expression>
loop
  <statement list>
end loop;
```

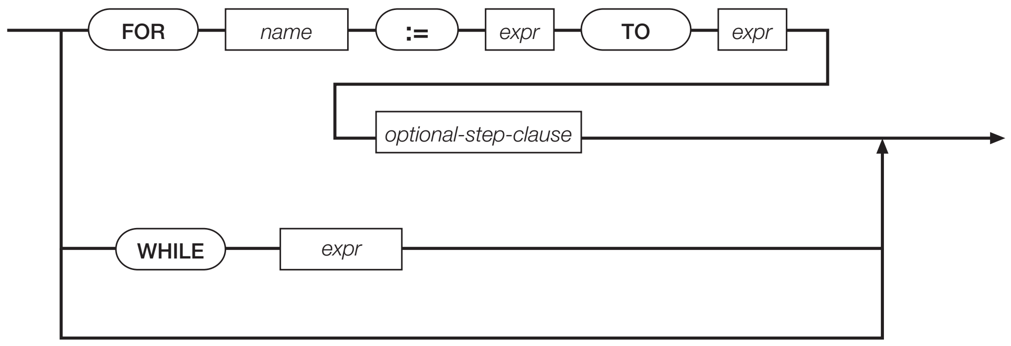


Figure 3-16. Optional Loop Iteration Clause Syntax

The optional step clause can be omitted if <*name*> is to increment by 1 after each run of the statement list. To increment <*name*> by 2 or 3, or decrement it by 1 or 2, then use the step clause. The step expression (–1 in the second example below) must be a constant.

```
for iCount := 97 to 122
loop
    strAlpha := strAlpha + chr$(iCount);
end loop;

for iCount := 10 to 0 step -1
loop
    if iCount = 0 then
      strMissionControl := "Blast off!";
    else
      strMissionControl := IntegerToString(iCount, 2);
    end if;
end loop;
```

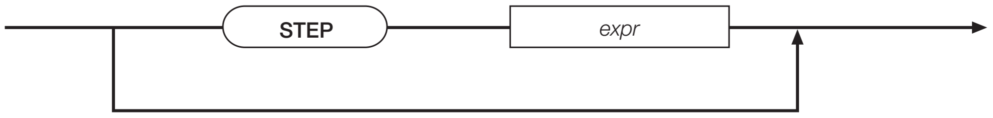


Figure 3-17. Optional Step Clause Syntax

Note ***Use caution when designing loops to ensure that an infinite loop is not created. If the program encounters an infinite loop, only the loop will run; subsequent queued events will not be run.***

3.4.5 Return Statement

The ***return*** statement can only be used inside of subprograms (functions, procedures, and event handlers). The ***return*** statement in procedures and handlers cannot return a value. An explicit return statement inside a procedure or handler is not required since the compiler will insert one if the ***return*** statement is missing. To return from a procedure or handler before the code body is done executing, use the ***return*** statement to exit at that point.

```
procedure DontDoMuch;
begin
if PromptUser("circle: ") <> SysOK then
    return;
  end if;
end;
```

Functions must return a value and an explicit ***return*** statement is required. The data type of the expression returned must be compatible with the return type specified in the function declaration.

```
function Inc(var viNumber : integer) : integer;
begin
  viNumber := viNumber + 1;
  return viNumber;
end;
```

It is permissible to have more than one ***return*** statement in a subprogram, but not recommended. In most instances it is better programming practice to use conditional execution (using the ***if*** statement) with one ***return*** statement at the end of the function than it is to use a ***return*** statement multiple times. ***Return*** statements liberally dispersed through a subprogram body can result in dead code (code that never gets executed) and hard-to-find bugs.

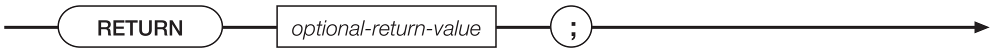


Figure 3-18. Return Statement Syntax

3.4.6 Exit Statement

The ***exit*** statement is only allowed in loops. It is used to immediately exit any loop (loop-until, for-loop, while-loop) it is called from. Sometimes it is convenient to be able to exit from a loop instead of testing at the top. In the case of nested loops (a loop inside another loop), only the innermost enclosing loop will be exited. See the loop examples in Section 3.4.4 on page 23 for the ***exit*** statement in action.

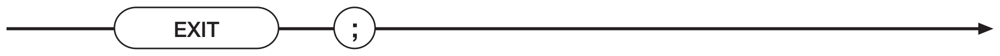


Figure 3-19. Exit Statement Syntax

4.0 Built-in Types

The following built-in types are used in parameters passed to and from the functions described in this section.

Code	Parameters
BatchingMode 920i 820i 880 1280	Off, Auto, Manual
BatchStatus 920i 820i 880 1280	BatchComplete, BatchStopped, BatchRunning, BatchPaused
BusImage 920i 820i 1280	array[32] of integer
BusImageReal 920i 820i 1280	array[32] of real
Color_type 920i	White, Black
DataArray 920i 1280	array[300] of real
Decimal_type 920i 820i 880 1280	DP_8_888888, DP_88_88888, DP_888_8888, DP_8888_888, DP_88888_88, DP_888888_8, DP_8888888, DP_8888880, DP_8888800, DP_DEFAULT
DisplayImage 920i	array[2402] of integer
DTComponent 920i 820i 880 1280	DateTimeYear, DateTimeMonth, DateTimeDay, DateTimeHour, DateTimeMinute, DateTimeSecond
ExtFloatArray 920i	array[5] of integer
FileAccessMode 920i 820i 1280	FileCreate, FileAppend, FileRead
FileDevice 1280	USB, SDCard
FileLineTermination 920i 820i 1280	FileCRLF, FileCR, FileLF
GraphType 920i	Line, Bar, XY

Table 4-1. Built-in Types

Code	Parameters
HW_array_type 920i 820i 880 1280	array[14] of HW_type
HW_type 880 1280	NoCard, DualSerial, DualAtoD, SingleAtoD, AnalogOut, DigitalIO, Profibus, AnalogInput, DualAnalogOut, Relay
HW_type 920i 820i	NoCard, DualSerial, DualAtoD, SingleAtoD, AnalogOut, DigitalIO, Pulse, Memory, reservedCard, DeviceNet, Profibus, Ethernet, ABRIO, AnalogInput, ControlNet, DualAnalogOut
IQValType 920i	IQSys, IQPlat, IQRawLC, IQCorrLC, IQZeroLC, IQStatLC, IQ2ScaleWt, IQ2StatusLC
Keys 880	GrossNetKey, UnitsKey, ZeroKey, TareKey, PrintKey, N1KEY, N4KEY, N7KEY, DecpntKey, NavUpKey, NavLeftKey, EnterKey, N2KEY, N5KEY, N8KEY, N0KEY, NavRightKey, NavDownKey, N3KEY, N6KEY, N9KEY, ClearKey, TimeDateKey, DisplayTareKey, DisplayAccumKey, MenuKey
Keys 920i 820i 1280	Soft4Key, Soft5Key, GrossNetKey, UnitsKey, Soft3Key, Soft2Key, Soft1Key, ZeroKey, Undefined3Key, Undefined4Key, TareKey, PrintKey, N1KEY, N4KEY, N7KEY, DecpntKey, NavUpKey, NavLeftKey, EnterKey, Undefined5Key, N2KEY, N5KEY, N8KEY, N0KEY, Undefined1Key, Undefined2Key, NavRightKey, NavDownKey, N3KEY, N6KEY, N9KEY, ClearKey, TimeDateKey, WeighInKey, WeighOutKey, ID_EntryKey, DisplayTareKey, TruckRegsKey, DisplayAccumKey, ScaleSelectKey, DisplayROCKey, SetpointKey, BatchStartKey, BatchStopKey, BatchPauseKey, BatchResetKey, DiagnosticsKey, ContactsKey, DoneKey, TestKey, ContrastKey, LLStopKey, LLGoKey, LLOffKey, AuditKey, USBKey
Mode 920i 820i 880 1280	GrossMode, NetMode, TareMode
OnOffType 920i 1280	VOff, Von
PrintFormat 880	GrossFmt, NetFmt, SPFmt, AccumFmt
PrintFormat 920i 820i 1280	GrossFmt, NetFmt, AuxFmt, TrWInFmt, TrRegFmt, TrWOutFmt, SPFmt, AccumFmt, AlertFmt, AuxFmt1, AuxFmt2, AuxFmt3, AuxFmt4, AuxFmt5, AuxFmt6, AuxFmt7, AuxFmt8, AuxFmt9, AuxFmt10, AuxFmt11, AuxFmt12, AuxFmt13, AuxFmt14, AuxFmt15, AuxFmt16, AuxFmt17, AuxFmt18, AuxFmt19, AuxFmt20
SysCode 920i 820i 880 1280	SysOk, SysLFTViolation, SysOutOfRange, SysPermissionDenied, SysInvalidScale, SysBatchRunning, SysBatchNotRunning, SysNoTare, SysInvalidPort, SysQFull, SysInvalidUnits, SysInvalidSetpoint, SysInvalidRequest, SysInvalidMode, SysRequestFailed, SysInvalidKey, SysInvalidWidget, SysInvalidState, SysInvalidTimer, SysNoSuchDatabase, SysNoSuchRecord, SysDatabaseFull, SysNoSuchColumn, SysInvalidCounter, SysDeviceError, SysInvalidChecksum, SysDatabaseAccessTimeout, SysNoFileOpen, SysFileNotFound, SysInvalidFileFormat, SysDirectoryNotFound, SysFileReadOnly, SysFileExists, SysNoFileSystemFound, SysFileOpen, SysEndOfFile, SysNoRoomOnMedia, SysMediaChanged, SysDeviceNotFound, SysNoUSB, SysPortBusy, SysDeviceChange, SysDeviceAdded, SysBadFileName
TareType 920i 820i 880 1280	NoTare, PushbuttonTare, KeyedTare

Table 4-1. Built-in Types

Code	Parameters
TimerMode 920i 820i 880 1280	TimerOneShot, TimerContinuous, TimerDigoutON, TimerDigoutOFF
Units 920i 820i 880 1280	Primary, Secondary, Tertiary
UnitType 920i 820i 880 1280	pound, kilogram, gram, ounce, short_ton, metric_ton, grain, troy_ounce, troy_pound, long_ton, custom, units_off, none
USBDeviceType 920i 820i 1280	USBNoDevice, USBHostPC, USBPrinter1, USBPrinter2, USBKeyboard, USBFileSystem
WeightCollectionArray 920i	array[8000] of real
WgtMsg 920i	array[12] of integer

Table 4-1. Built-in Types

4.1 Using SysCode Data

SysCode data can be used to take some action based on whether or not a function completed successfully.

Example: The following code checks the SysCode result following a GetTare function. If the function completed successfully, the retrieved tare weight is written to Port 1:

```
Procedure GetTareWeight
SysResult : SysCode;
TareWeight : Real;
begin
 SysResult:= GetTare(1, Primary, TareWeight);
 If SysResult = SysOk then
  WriteLn(1, “The current tare weight is “ + realtostring(TareWeight,0,4));
 end if;
end;
```

5.0 API Reference

This section lists the application programming interfaces (APIs) used to program the indicator. Functions are grouped according to the kinds of operations they support.

Note *If you are unsure whether your version of software supports a given API, check the system.src file to see if the API is present.*

5.1 Scale Data Acquisition

Note *Unless otherwise stated, when an API with a VAR parameter returns a SysCode value other than SysOK, the VAR parameter is not changed.*

5.1.1 Weight Acquisition

Method	Description
GetGross	Sets `W` to the current gross weight value of scale `S`, in the units specified by `U`. `W` will contain a weight value even if the scale is in programmed overload.
920i	**Method Signature:**
820i	`function GetGross (S : Integer; U : Units; VAR W : Real) : SysCode;`
880	**Parameters:**
1280	[in] `S` Scale number
	[in] `U` Units (Primary, Secondary, Tertiary)
	[out] `W` Gross weight
	SysCode values returned:
	SysInvalidScale — The scale specified by S does not exist.
	SysInvalidUnits — The units specified by U is not valid.
	SysInvalidRequest — The requested value is not available.
	SysDeviceError — The scale is reporting an error condition.
	SysOK — The function completed successfully.
	Example:
	`GrossWeight : Real;`
	…
	`GetGross (Scale1, Primary, GrossWeight);`
	`WriteLn (Port1, "Current gross weight is", GrossWeight);`
GetNet	Sets `W` to the current net weight value of scale `S`, in the units specified by `U`. `W` will contain a weight value even if the scale is in programmed overload.
920i	**Method Signature:**
820i	`function GetNet (S : Integer; U : Units; VAR W : Real) : SysCode;`
880	**Parameters:**
1280	[in] `S` Scale number
	[in] `U` Units (Primary, Secondary, Tertiary)
	[out] `W` Net weight
	SysCode values returned:
	SysInvalidScale — The scale specified by S does not exist.
	SysInvalidUnits — The units specified by U is not valid.
	SysInvalidRequest — The requested value is not available.
	SysDeviceError — The scale is reporting an error condition.
	SysOK — The function completed successfully.
	Example:
	`NetWeight : Real;`
	…
	`GetNet (Scale2, Secondary, NetWeight);`
	`WriteLn (Port1, "Current net weight is", NetWeight);`

Table 5-1. Weight Acquisition Methods

Method	Description

GetTare
920i
820i
880
1280
	Sets `W` to the tare weight of scale `S` in weight units specified by `U`.
	Method Signature:
	`function GetTare (S : Integer; U : Units; VAR W : Real) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[in] `U` Units (Primary, Secondary, Tertiary)
	[out] `W` Tare weight
	SysCode values returned:
	SysInvalidScale — The scale specified by S does not exist.
	SysInvalidUnits — The units specified by U is not valid.
	SysInvalidRequest — The requested value is not available.
	SysNoTare — The specified scale has no tare. W is set to 0.0.
	SysDeviceError — The scale is reporting an error condition.
	SysOK — The function completed successfully.
	Example:
	`TareWeight : Real;`
	…
	`GetTare (Scale3, Tertiary, TareWeight);`
	`WriteLn (Port1, "Current tare weight is ", TareWeight);`

GetFilteredCount
920i
820i
880
1280
	Sets `C` to the current filtered A/D count for scale `S`.
	Method Signature:
	`function GetFilteredCount (S : Integer; VAR C : Integer) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[out] `C` Current filtered A/D count
	SysCode values returned:
	SysInvalidScale — The scale specified by S does not exist.
	SysInvalidRequest — The scale specified by S is not an A/D-based scale.
	SysDeviceError — The scale is reporting an error condition.
	SysOK — The function completed successfully.
	Example:
	`FilterCount : Integer;`
	…
	`GetFilteredCount (1; FilterCount);`

GetRawCount
920i
820i
880
1280
	Sets `C` to the current raw A/D count for scale `S`.
	Method Signature:
	`function GetRawCount (S : Integer; VAR C : Integer) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[out] `C` Current raw A/D count
	SysCode values returned:
	SysInvalidScale — The scale specified by S does not exist.
	SysInvalidRequest — The scale specified by S is not an A/D-based scale.
	SysDeviceError — The scale is reporting an error condition.
	SysOK — The function completed successfully.
	Example:
	`RawCount : Integer;`
	…
	`GetRawCount (1; RawCount);`

Table 5-1. Weight Acquisition Methods (Continued)

Method	Description
GetCapacity 1280	Sets `C` to the configured capacity for scale `S` and units `U`. **Method Signature:** `function Get Capacity (S : Integer; U : Units; VAR C : Real) : SysCode;` **Parameters:** [in] S Scale number [out] C Scale capacity **SysCode values returned:** SysInvalidScale The scale specified by S does not exist. SysInvalidUnits The units value U is not valid. SysOK The function completed successfully.

Table 5-1. Weight Acquisition Methods (Continued)

5.1.2 Weight Data Recording

There are two methods to record weight readings into an array at a high rate of speed – DataRecording and WeightCollection.

DataRecording

DataRecording allows raw weights to be stored to a user program-specified array on each iteration of the scale processor. Recording begins when the Start Setpoint (start_sp_ is satisfied and ends when the Stop Setpoint (stop_sp) is satisfied.

Methods	Description
InitData Recording 920i	Specifies the data array used for the recording, scale number, and the start and stop setpoint numbers. ***If the setpoint conditions return to the start conditions (start_up satisfied, stop_sp not satisfied_, recording will continue at the array location where it left off. Thus, a continuous batch will need to call CloseDataRecording to stop recording, then call InitDataRecording to restart data recording at the beginning of the array.*** **Method Signature:** `Function InitDataRecording (data : DataArray; scale_no : Integer; start_sp : Integer; stop_sp : Integer) : SysCode;` **Parameters:** [in] data Data array name [in] scale_no Scale Number [in] start_sp Start setpoint number [in] stop_sp Stop setpoint number **SysCode values returned:** SysRequestFailed The function did not complete SysOk The function completed successfully
CloseData Recording 920i	Turns off data recording started with InitDataRecording. This procedure removes all connections to the data recording function. To restart data recording, use the InitDataRecording function. **Method Signature:** `Procedure CloseDataRecording (scale_no : Integer);` **Parameters:** [in] scale_no Scale Number
GetData RecordSize 920i	Returns the number of data points recorded in the user-specified data array. **Method Signature:** `Function GetDataRecordSize(scale_no : Integer) : Integer;` **Parameters:** [in] scale_no Scale Number **Value Returned:** [out] number The number of data points recorded

Table 5-2. Data Recording Methods

Methods	Description
SetDataRecord Precision 920i	Sets the data recording to high precision. **Method Signature:** `Function SetDataRecordPrecision (scale_no : Integer; precision : OnOffType) : SysCode;` **Parameters:** [in] scale_no Scale Number [in] precision OnOffType Von or VOff **SysCode values returned:** SysRequestFailed The function did not complete SysOk The function completed successfully

Table 5-2. Data Recording Methods

WeightCollection

WeightCollection allows the recording of weights, at the A/D update rate, to a user-specified array of type WeightCollectionArray.

Methods	Description
StartWeight Collection 920i	Starts the collection of weight data, from the specified scale, to the user specified array. **Method Signature:** `Function StartWeightCollection (scale_no : Integer; data : WeightCollectionArray) : SysCode;` **Parameters:** [in] scale_no Scale Number [in] data Data array name **SysCode values returned:** SysRequestFailed The function did not complete. SysOk The function completed successfully.
StopWeight Collection 920i	Stops the collection of weight data that was started with StartWeightCollection, and returns the number of data points recorded in the user-specified data array. **Method Signature:** `Function StopWeightCollection(scale_no : Integer) : Integer;` **Parameters:** [in] scale_no Scale Number **Value Returned:** [out] number The number of data points recorded.

Table 5-3. Weight Collection Methods

5.1.3 Tare Manipulation

Methods	Description

AcquireTare
920i
820i
880
1280
	Acquires a pushbutton tare from scale `S`.
	Method Signature:
	`function AcquireTare (S : Integer) : SysCode;`
	Parameters:
	[in] `S` Scale number
	SysCode values returned:
	SysInvalidRequest — The specified scale is Legal for Trade Serial Scale. No tare is acquired.
	SysInvalidScale — The scale specified by S does not exist or is a program scale.
	SysLFTViolation — The tare operation would violate configured legal-for-trade restrictions for the specified scale. No tare is acquired.
	SysOutOfRange — The tare operation would acquire a tare that may cause a display overload. No tare is acquired.
	SysPermissionDenied — The tare operation would violate configured tare acquisition restrictions for the specified scale. No tare is acquired.
	SysDeviceError — The scale is reporting an error condition.
	SysOK — The function completed successfully.
	Example:
	`AcquireTare (Scale1);`

ClearTare
920i
820i
880
1280
	Removes the tare associated with scale `S` and sets the tare type associated with the scale to `NoTare`.
	Method Signature:
	`function ClearTare (S : Integer) : SysCode;`
	Parameters:
	[in] `S` Scale number
	SysCode values returned:
	SysInvalidRequest — The specified scale is Legal for Trade Serial Scale. No tare is acquired.
	SysInvalidScale — The scale specified by S does not exist or is a program scale.
	SysNoTare — The scale specified by S has no tare.
	SysDeviceError — The scale is reporting an error condition.
	SysOK — The function completed successfully.
	Example:
	`ClearTare (Scale1);`

GetTareType
920i
820i
880
1280
	`Sets T to indicate type of tare currently on scale S.`
	Method Signature:
	`function GetTareType (S : Integer; VAR T : TareType) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[out] `T` Tare type
	TareType values returned:
	`NoTare` — There is no tare value associated with the specified scale.
	`PushbuttonTare` — The current tare was acquired by pushbutton.
	`KeyedTare` — The current tare was acquired by key entry or by setting the tare.
	SysCode values returned:
	SysDeviceError — The scale is reporting an error condition. `T` is still set to the tare type.
	SysInvalidScale — The scale specified by S does not exist or is a program scale. T is unchanged.
	`SysOK` — The function completed successfully.
	Example:
	`TT : TareType;`
	`…`
	`GetTareType (Scale1, TT);`
	`if TT=KeyedTare then …`

Table 5-4. Tare Manipulation Methods

Methods	Description

SetTare
920i
820i
880
1280
	Sets the tare weight for the specified channel.
	Method Signature:
	`function SetTare (S : Integer; U : Units; W : Real) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[in] `U` Units (Primary, Secondary, Tertiary)
	[in] `W` Tare weight
	SysCode values returned:
	`SysInvalidRequest` The specified scale is Legal for Trade Serial Scale. No tare is acquired.
	`SysPermissionDenied` The tare operation would violate configured tare acquisition restrictions for the specified scale. No tare is acquired.
	`SysInvalidScale` The scale specified by `S` does not exist or is a program scale.
	`SysInvalidUnits` The units specified by `U` is not valid.
	`SysLFTViolation` The tare operation would violate configured legal-for-trade restrictions for the specified scale. No tare is acquired.
	`SysOutOfRange` The tare operation would acquire a tare that may cause a display overload. No tare is acquired.
	`SysDeviceError` The scale is reporting an error condition.
	`SysOK` The function completed successfully.
	Example:
	`DesiredTare : Real;`
	…
	`DesiredTare := 1234.5;`
	`SetTare (Scale1, Primary, DesiredTare);`

Table 5-4. Tare Manipulation Methods (Continued)

5.1.4 Rate of Change

Methods	Description

GetROC
920i
820i
1280
	Sets `R` to the current rate-of-change value of scale S.
	Method Signature:
	`function GetROC (S : Integer; VAR R : Real) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[out] `R` Rate of change value
	SysCode values returned:
	`SysInvalidRequest` The scale specified by S is not an A/D scale, an industrial serial scale, or Rate of Change is not supported.
	`SysInvalidScale` The scale specified by `S` does not exist.
	`SysDeviceError` The scale is reporting an error condition.
	`SysOK` The function completed successfully.
	Example:
	`ROC : Real;`
	…
	`GetROC (Scale3, ROC);`
	`WriteLn (Port1, "Current ROC is", ROC);`

Table 5-5. Rate of Change Command

5.1.5 Accumulator Operations

Methods	Description

ClearAccum
920i
820i
880
1280
	Sets the value of the accumulator for scale `S` to zero.
	Method Signature:
	`function ClearAccum (S : Integer) : SysCode;`
	Parameters:
	[in] `S` Scale number
	SysCode values returned:
	`SysInvalidScale` The scale specified by `S` does not exist.
	`SysPermissionDenied` The accumulator is not enabled for the specified scale.
	`SysDeviceError` The scale is reporting an error condition.
	`SysOK` The function completed successfully.
	Example:
	`ClearAccum (Scale1);`

GetAccum
920i
820i
880
1280
	Sets `W` to the value of the accumulator associated with scale `S`, in the units specified by `U`.
	Method Signature:
	`function GetAccum (S : Integer; U : Units; VAR W ; Real) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[in] `U` Units (Primary, Secondary, Tertiary)
	[out] `W` Accumulated weight
	SysCode values returned:
	SysInvalidScale The scale specified by `S` does not exist.
	`SysInvalidUnits` The units specified by `U` is not valid.
	`SysDeviceError` The scale is reporting an error condition. `D` is still updated with the date of the most recent accumulation.
	`SysPermissionDenied` The accumulator is not enabled for the specified scale.
	`SysOK` The function completed successfully.
	Example:
	`AccumValue : Real;`
	…
	`GetAccum (Scale1, AccumValue);`

GetAccumCount
920i
820i
880
1280
	Sets `N` to the number of accumulations performed for scale `S` since its accumulator was last cleared.
	Method Signature:
	`function GetAccumCount (S : Integer; VAR N ; Integer) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[out] `N` Accumulator count
	SysCode values returned:
	`SysInvalidScale` The scale specified by `S` does not exist.
	`SysPermissionDenied` The accumulator is not enabled for the specified scale.
	`SysDeviceError` The scale is reporting an error condition.
	`SysOK` The function completed successfully.
	Example:
	`NumAccums : Integer;`
	…
	`GetAccumCount (Scale1, NumAccums);`

Table 5-6. Accumulator Operation Methods

Methods	Description

GetAccumDate
920i
820i
880
1280
	Sets `D` to the date of the most recent accumulation performed by scale `S`.
	Method Signature:
	`function GetAccumDate (S : Integer; VAR D ; String) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[out] `D` Accumulator date
	SysCode values returned:
	`SysInvalidScale` The scale specified by `S` does not exist.
	`SysPermissionDenied` The accumulator is not enabled for the specified scale.
	`SysDeviceError` The scale is reporting an error condition. `D` is still updated with the date of the most recent accumulation.
	`SysOK` The function completed successfully.
	Example:
	`AccumDate : String;`
	…
	`GetAccumDate (Scale1, AccumDate);`

GetAccumTime
920i
820i
880
1280
	Sets `T` to the time of the most recent accumulation performed by scale `S`.
	Method Signature:
	`function GetAccumTime (S : Integer; VAR T ; String) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[out] `T` Accumulator time
	SysCode values returned:
	`SysInvalidScale` The scale specified by `S` does not exist.
	`SysPermissionDenied` The accumulator is not enabled for the specified scale.
	`SysDeviceError` The scale is reporting an error condition. `T` is still updated with the time of the most recent accumulation.
	`SysOK` The function completed successfully.
	Example:
	`AccumTime : String;`
	…
	`GetAccumTime (Scale1, AccumTime);`

GetAvgAccum
920i
820i
880
1280
	Sets `W` to the average accumulator value associated with scale `S`, in the units specified by `U`, since the accumulator was last cleared.
	Method Signature:
	`function GetAvgAccum (S : Integer; U : Units; VAR W ; Real) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[in] `U` Units (Primary, Secondary, Tertiary)
	[out] `W` Average accumulator weight
	SysCode values returned:
	`SysInvalidScale` The scale specified by `S` does not exist.
	`SysInvalidUnits` The units specified by `U` is not valid.
	`SysDeviceError` The scale is reporting an error condition. `W` is still updated with the average accumulator value.
	`SysPermissionDenied` The accumulator is not enabled for the specified scale.
	`SysOK` The function completed successfully.
	Example:
	`AvgAccum : Real;`
	…
	`GetAvgAccum (Scale1, AvgAccum);`

Table 5-6. Accumulator Operation Methods (Continued)

Methods	Description

SetAccum
920i
820i
880
1280
	Sets the value of the accumulator associated with scale `S` to weight `W`, in units specified by `U`.
	Method Signature:
	`function SetAccum (S : Integer; U : Units; W : Real) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[in] `U` Units (Primary, Secondary, Tertiary)
	[in] `W` Accumulator value
	SysCode values returned:
	`SysInvalidScale` The scale specified by `S` does not exist.
	`SysInvalidUnits` The units specified by `U` is not valid.
	`SysDeviceError` The scale is reporting an error condition.
	`SysPermissionDenied` The accumulator is not enabled for the specified scale.
	Note ***If the units specified by U are Secondary or Tertiary, the scale has to be either an A/D scale or a total scale. If not A/D scale or a total scale then SysPermissionDenied will be returned.***
	If the units specified by U are Primary, the scale can be any type.
	`SysOK` The function completed successfully.
	
	Example:
	`AccumValue : Real;`
	…
	`AccumValue := 110.5`
	`SetAccum (Scale1, Primary, AccumValue);`

Table 5-6. Accumulator Operation Methods (Continued)

5.1.6 Scale Operation

Methods	Description

CurrentScale
920i
820i
880
1280
	Sets `S` to the numeric ID of the currently displayed scale.
	Method Signature:
	`function CurrentScale : Integer;`
	Example:
	`ScaleNumber : Integer;`
	…
	`ScaleNumber := CurrentScale;`

GetMode
920i
820i
880
1280
	Sets `M` to the value representing the current display mode for scale `S`.
	Method Signature:
	`function GetMode (S : Integer; VAR M : Mode) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[out] `U` Current display mode
	Mode values returned:
	`GrossMode` Scale `S` is currently in gross mode.
	`NetMode` Scale `S` is currently in net mode.
	SysCode values returned:
	`SysInvalidScale` The scale specified by `S` does not exist or is a program scale.
	`SysDeviceError` The scale is reporting an error condition. `M` is still updated with the current display mode.
	`SysOK` The function completed successfully.
	Example:
	`CurrentMode : Mode;`
	…
	`GetMode (Scale1, CurrentMode);`

Table 5-7. Scale Operation Methods

Methods	Description

GetUnits
920i
820i
880
1280
	Sets U to the value representing the current display units for scale S.
	Method Signature:
	`function GetUnits (S : Integer; VAR U : Units) : SysCode;`
	Parameters:
	[in] S Scale number
	[out] U Current display units
	Units values returned:
	`Primary` Primary units are currently displayed on scale S.
	`Secondary` Secondary units are currently displayed on scale S.
	`Tertiary` Tertiary units are currently displayed on scale S.
	SysCode values returned:
	`SysInvalidScale` The scale specified by S does not exist or is a program scale.
	`SysDeviceError` The scale is reporting an error condition.
	`SysOK` The function completed successfully.
	Example:
	`CurrentUnits : Units;`
	...
	`GetUnits (Scale1, CurrentUnits);`

GetUnitsString
920i
820i
880
1280
	Sets V to the text string representing the current display units for scale S.
	Method Signature:
	`function GetUnitsString (S : Integer; U : Units; VAR V : String) : SysCode;`
	Parameters:
	[in] S Scale number
	[in] U Units (Primary, Secondary, Tertiary)
	[out] V Current display units string
	Units values sent:
	`Primary` Get the Primary units string for scale S.
	`Secondary` Get the Secondary units string for scale S.
	`Tertiary` Get the Tertiary units string for scale S.
	SysCode values returned:
	`SysInvalidScale` The scale specified by S does not exist or is a program scale.
	`SysInvalidUnits` The units value specified by U does not exist.
	`SysOK` The function completed successfully.
	Example:
	`CurrentUnitsString : Units;`
	...
	`GetUnitsString (Scale1, Primary, CurrentUnitsString);`

InCOZ
920i
820i
880
1280
	Sets V to a non-zero value if scale S is within 0.25 grads of gross zero. If the condition is not met, V is set to zero.
	Method Signature:
	`function InCOZ (S : Integer; VAR V : Integer) : SysCode;`
	Parameters:
	[in] S Scale number
	[in] V Center-of-zero value
	SysCode values returned:
	`SysInvalidScale` The scale specified by S does not exist or is a program scale.
	`SysDeviceError` The scale is reporting an error condition.
	`SysOK` The function completed successfully
	Example:
	`ScaleAtCOZ : Integer;`
	...
	`InCOZ (Scale1, ScaleAtCOZ);`

Table 5-7. Scale Operation Methods (Continued)

Methods	Description

InMotion
920i
820i
880
1280
	Sets V to a non-zero value if scale S is in motion. Otherwise, V is set to zero.
	Method Signature:
	`function InMotion (S : Integer; VAR V : Integer) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[out] `V` In-motion value
	SysCode values returned:
	`SysInvalidScale` The scale specified by S does not exist or is a program scale.
	`SysDeviceError` The scale is reporting an error condition.
	`SysOK` The function completed successfully
	Example:
	`ScaleInMotion : Integer;`
	…
	`InMotion (Scale1, ScaleInMotion);`

InRange
920i
820i
880
1280
	Sets V to zero value if scale S is in an overload or underload condition. Otherwise, V is set to a non-zero value.
	Method Signature:
	`function InRange (S : Integer; VAR V : Integer) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[in] `V` In-range value
	SysCode values returned:
	`SysInvalidScale` The scale specified by S does not exist or is a program scale.
	`SysDeviceError` The scale is reporting an error condition.
	`SysOK` The function completed successfully
	Example:
	`ScaleInRange : Integer;`
	…
	`InRange (Scale1, ScaleInRange);`

SelectScale
920i
820i
1280
	Sets scale S as the current scale.
	Method Signature:
	`function SelectScale (S : Integer) : SysCode;`
	Parameters:
	[in] `S` Scale number
	SysCode values returned:
	`SysInvalidScale` The scale specified by S does not exist. The current scale is not changed
	`SysOK` The function completed successfully.
	Example:
	`SelectScale (Scale1);`

SetMode
920i
820i
880
1280
	Sets the current display mode on scale S to `M`.
	Method Signature:
	`function SetMode (S : Integer; M : Mode) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[in] `M` Scale mode
	Mode values sent:
	`GrossMode` Scale S is set to gross mode.
	`NetMode` Scale S is set to net mode.
	SysCode values returned:
	`SysInvalidScale` The scale specified by S does not exist or is a program scale.
	`SysInvalidMode` The mode value `M` is not valid.
	`SysDeviceError` The scale is reporting an error condition. The mode is not changed.
	`SysOK` The function completed successfully.
	Example:
	`SetMode (Scale1, Gross);`

Table 5-7. Scale Operation Methods (Continued)

Methods	Description

SetUnits
920i
820i
880
1280
	Sets the current display units on scale `S` to `U`.
	Method Signature:
	`function SetUnits (S : Integer; U : Units) : SysCode;`
	Parameters:
	[in] `S` Scale number
	[in] `U` Scale units
	Units values sent:
	`Primary` Primary units will be displayed on scale `S`.
	`Secondary` Secondary units will be displayed on scale `S`.
	`Tertiary` Tertiary units will be displayed on scale `S`.
	SysCode values returned:
	`SysInvalidRequest` The scale specified by `S` is a legal for trade or industrial serial scale.
	`SysInvalidScale` The scale specified by `S` does not exist or is a program scale.
	`SysInvalidUnits` The units value `U` is not valid.
	`SysDeviceError` The scale is reporting an error condition.
	`SysOK` The function completed successfully.
	Example:
	`SetUnits (Scale1, Secondary);`

ZeroScale
920i
820i
880
1280
	Performs a gross zero scale operation for `S`.
	Method Signature:
	`function ZeroScale (S : Integer) : SysCode;`
	Parameters:
	[in] `S` Scale number
	SysCode values returned:
	`SysInvalidRequest` The scale specified by `S` is a legal for trade serial scale.
	`SysInvalidScale` The scale specified by `S` does not exist or is a program scale.
	`SysLFTViolation` The zero operation would violate configured legal-for-trade restrictions for the specified scale. No zero is performed.
	`SysOutOfRange` The zero operation would exceed the configured zeroing limit. No zero is acquired.
	`SysDeviceError` The scale is reporting an error condition.
	`SysOK` The function completed successfully.
	Example:
	`ZeroScale (Scale1);`

GetCountBy 920i 820i 880 1280	Sets `C` to the real count-by value on scale `S`, in units `U`. **Method Signature:** `function GetCountBy (S : Integer; U : Units; VAR C : Real) : SysCode;` **Parameters:** [in] `S` Scale number [in] `U` Units (Primary, Secondary, Tertiary) [out] `C` Count-by value **SysCode values returned:** `SysInvalidScale` The scale specified by `S` does not exist. `SysInvalidUnits` The units specified by `U` is not recognized. `SysInvalidRequest` The scale specified by `S` does not support this operation (serial scale). `SysDeviceError` The scale is reporting an error condition. `C` is still updated with the count-by value. `SysOK` The function completed successfully.
GetGrads 920i 820i 880 1280	Sets `G` to the configured grad value of scale `S`. **Method Signature:** `function GetGrads (S : Integer; VAR G : Integer) : SysCode;` **Parameters:** [in] `S` Scale number [out] `G` Grads value **SysCode values returned:** `SysInvalidScale` The scale specified by `S` does not exist. `SysInvalidRequest` The scale specified by `S` does not support this operation (serial scale). `SysDeviceError` The scale is reporting an error condition. `SysOK` The function completed successfully.

Table 5-7. Scale Operation Methods (Continued)

5.1.7 Calibration Data

Methods	Description
GetLCCD 920i 820i 880 1280	Sets V to the calibrated deadload count for scale S. **Method Signature:** `function GetLCCD (S : Integer; VAR V : Integer) : SysCode;` **Parameters:** [in] S Scale number [out] V Deadload count **SysCode values returned:** `SysInvalidScale` The scale specified by S does not exist. `SysInvalidRequest` The scale specified by S is not an A/D-based scale. `SysOK` The function completed successfully.
GetLCCW 920i 820i 880 1280	Sets V to the calibrated span count for scale S. **Method Signature:** `function GetLCCW (S : Integer; VAR V : Integer) : SysCode;` **Parameters:** [in] S Scale number [out] V Calibrated span count **SysCode values returned:** `SysInvalidScale` The scale specified by S does not exist. `SysInvalidRequest` The scale specified by S is not an A/D-based scale. `SysOK` The function completed successfully.
GetLCCC 1280	Sets V to the calibrated load cell count at capacity for scale S. **Method Signature** `function GetLCCC (S : Integer; VAR V : Integer) : SysCode;` **Parameters:** [in] S Scale number [out] V Load cell count at capacity **SysCode values returned:** SysInvalidScale The scale specified by S does not exist SysInvalidRequest The scale specified by S is not an A/D-based scale SysOk The function completed successfully
GetWVal 920i 820i 880 1280	Sets V to the configured WVAL (test weight value) for scale S. **Method Signature:** `function GetWVal (S : Integer; VAR V : Real) : SysCode;` **Parameters:** [in] S Scale number [out] V Test weight value **SysCode values returned:** `SysInvalidScale` The scale specified by S does not exist. `SysInvalidRequest` The scale specified by S is not an A/D-based scale. `SysOK` The function completed successfully.
GetZeroCount 920i 820i 880 1280	Sets V to the acquired zero count for scale S. **Method Signature:** `function GetZeroCount (S : Integer; VAR V : Integer) : SysCode;` **Parameters:** [in] S Scale number [out] V Zero count **SysCode values returned:** `SysInvalidScale` The scale specified by S does not exist. `SysInvalidRequest` The scale specified by S is not an A/D-based scale. `SysOK` The function completed successfully.

Table 5-8. Calibration Data Methods

5.2 System Support

Methods	Description
Date$ 920i 820i 880 1280	Returns a string representing the system date contained in `DT`. **Method Signature:** `function Date$ (DT : DateTime) : String;`
DisableHandler 920i 820i 880 1280	Disables the specified event handler. See Section 6.1 on page 83 for a list of handlers. **Method Signature:** `procedure DisableHandler (handler);` **SysCode values returned:** SysInvalidRequest — The specified handler does not exist. SysOK — The function completed successfully.
DisplayIs Suspended 920i 820i 880 1280	Returns a true (non-zero) value if the display is suspended (using the SuspendDisplay procedure), or a false (zero) value if the display is not suspended. **Method Signature:** `function DisplayIsSuspended : Integer;`
EnableHandler 920i 820i 880 1280	Enables the specified event handler. See Section 6.1 on page 83 for a list of handlers. **Method Signature:** `procedure EnableHandler (handler);` **SysCode values returned:** SysInvalidRequest — The specified handler does not exist. SysOK — The function completed successfully.

EventChar
920i
820i
880
1280
	Returns a one-character string representing the character received on a communications port that caused the ***PortxCharReceived*** event. If EventChar is called outside the scope of a ***PortxCharReceived*** event, EventChar returns a string of length zero. See Section 6.1 on page 83 for information about the ***PortxCharReceived*** event handler.
	Method Signature:
	`function EventChar : String;`
	Example:
	`handler Port4CharReceived;`
	`  strOneChar : string;`
	`begin`
	`  strOneChar := EventChar;`
	`end;`

EventConnection 1280	Returns the name of the communications connection that caused the PortxCharReceived or ConnectionHandler events. If EventConnection is called outside the scope of either of these events, a string of length zero is returned. **Method Signature:** `function EventConnection : string;`

EventKey
920i
820i
880
1280
	Returns an enumeration of type keys with the value corresponding to the key press that generated the event. See Section 4.0 on page 27 for a definition of the Keys data type.
	Method Signature:
	`function EventKey : Keys;`
	Example:
	`handler KeyPressed;`
	`begin`
	`  if EventKey = ClearKey then`
	`  …`
	`  end if;`
	`end;`

Table 5-9. System Support Methods

Methods	Description
EventPort 920i 820i 880 1280	Returns the communications port number that received an F#*x* serial command. This function extracts data from the Cmd*x*Handler event for the F#*x* command, if enabled. (The Cmd*x*Handler, if enabled, runs whenever a F#*x* command is received on any serial port.) If the Cmd*x*Handler is not enabled, this function returns 0 as the port number. **Method Signature:** `function EventPort : Integer;`
EventString 920i 820i 880 1280	Returns the string sent with an F#*x* serial command. This function extracts data from the Cmd*x*Handler event for the F#*x* command, if enabled. (The Cmd*x*Handler, if enabled, runs whenever a F#*x* command is received on any serial port.) If the Cmd*x*Handler is not enabled, or if no string is defined for the F#*x* command, this function returns a string of length zero. **Method Signature:** `function EventString : String;`
GetConsecNum 920i 820i 880 1280	Returns the value of the consecutive number counter. **Method Signature:** `function GetConsecNum : Integer;`
GetDate 920i 820i 880 1280	Extracts date information from `DT` and places the data in variables `Year`, `Month`, and `Day`. **Method Signature:** `procedure GetDate (DT : DateTime; VAR Year : Integer; VAR Month : Integer; VAR Day : Integer);` **Parameters:** [in] `DT` DateTime variable name [out] `Year` Year [out] `Month` Month [out] `Day` Day
GetIqubeData 920i	Returns data from a given iQube. The types that IQValType may be are: IQSys, IQPlat, IQRawLC, IQCorrLC, IQZeroLC, IQStatLC, IQScaleWt, and IQ2StatusLC. IQSys returns the system weight value. IQPlat returns the millivolt value for the indexed platform. IQRawLC returns the indexed raw load cell millivolt value. IQCorrLC returns the indexed corrected load cell millivolt value. IQZeroLC returns the indexed load cell deadload millivolt value. IQStatLC returns the indexed load cell status. IQ2ScaleWt returns the indexed scale weight value. IQSys and IQPlat are revised to also return the scale data. IQ2StatusLC returns the indexed load cell status. The old IQStatLC is not supported and will return SysInvalidRequest. Note ***When using with Firmware 4.xx/iQube2: The IQSys and IQPlat data types will return SysOk as long as the command is correctly formatted (i.e., scale exists). If you want to know whether the iQube2 is in an error condition, look at the value (not the syscode) of the IQ2StatusLC data type.*** **Method Signature:** `function GetIqubeData(port_no : integer; dataType : IQValType; index : integer; data : real) : SysCode;` **SysCode values returned:** `SysOutOfRange` The array index is less than or equal to 0. `SysInvalidRequest` The requested port is not configured as an iQube; the value cannot be returned due to the device configuration, i.e., trying to address load cell 17; certain requests while the diagnostic screen is open; or an invalid data type is requested. `SysDeviceError` The scale is reporting an internal error. `SysOK` The function completed successfully.

Table 5-9. System Support Methods (Continued)

Methods	Description

GetKey
920i
820i
880
1280
	Waits for a key press from the indicator front panel before continuing the program. The optional time-out is specified in 0.01-second intervals (1/100 seconds); if the wait time is set to zero, the procedure will wait indefinitely.
	Method Signature:
	`function GetKey (timeout : Integer);`
	Parameters:
	[in] `timeout` Time-out value
	Example:
	`this_key : Keys;`
	…
	`DisplayStatus ("Press [Enter] for Yes");`
	
	`this_key: = GetKey(0);`
	`if this_key = EnterKey then`
	`  DisplayStatus ("Yes");`
	`else`
	`  DisplayStatus ("No");`
	`end if;`

GetSoftware Version 920i 820i 880 1280	Returns the current software version. **Method Signature:** `function GetSoftwareVersion : String;`
GetTime 920i 820i 880 1280	Extracts time information from `DT` and places the data in variables `Hour`, `Minute`, and `Second`. **Method Signature:** `procedure GetTime (DT : DateTime; VAR Hour : Integer; VAR Minute : Integer; VAR Second : Integer);` **Parameters:** [in] `DT` DateTime variable name [out] `Hour` Hour [out] `Minute` Minute [out] `Second` Second
GetUID 920i 820i 880 1280	Returns the current unit identifier. **Method Signature:** `function GetUID : String;`

Hardware
920i
820i
880
1280
	Returns an array of HW_type. The elements of the array correspond to option card slots in the indicator. This API is useful for determining the presence of option cards that are required or that could activate different options in the user program.
	Method Signature:
	`procedure Hardware(var hw : HW_array_type);`
	SysCode values returned:
	`None`

Table 5-9. System Support Methods (Continued)

Methods	Description
KeyPress 920i 820i 880 1280	Provides intrinsic functionality for a key. The following keys will have intrinsic function, in addition to the front panel keys already in the Keys built-in type: TimeDateKey, WeighInKey, WeighOutKey, ID_EntryKey, DisplayTareKey, TruckRegsKey, DisplayAccumKey, ScaleSelectKey, DisplayROCKey, SetpointKey, BatchStartKey, BatchStopKey, BatchPauseKey, BatchResetKey, DiagnosticsKey, ContactsKey, DoneKey, TestKey,ContrastKey, LLStopKey, LLGoKey, LLOffKey, AuditKey, USBKey. The ContactsKey will actually function like the Dignostics softkey, while the DiagnosticsKey will go straight to the Diagnostics screen. The DoneKey will only return from the contacts screen. The TestKey will allow the user program to test for strict weigh mode by not doing anything at all. This API will only function in actual weigh mode. **Method Signature:** `function KeyPress (K : Keys) : SysCode;` **SysCode values returned:** `SysInvalidMode` The indicator is not actually in weigh mode. The TestKey will return SysInvalidMode for all sub-modes of weigh mode (ie, the contact screen) as well as any other mode (ie, time & date entry, or open prompt). `SysInvalidKey` Any Invalid key. Softkeys and Undefined Keys are considered invalid. `SysInvalidRequest` Processing the key returns invalid or error. `SysOK` The function completed successfully
LockKey 920i 820i 880 1280	Disables the specified front panel key. Possible values are: ZeroKey, GrossNetKey, TareKey, UnitsKey, PrintKey, Soft1Key, Soft2Key, Soft3Key, Soft4Key, Soft5Key, NavUpKey, NavRightKey, NavDownKey, NavLeftKey, EnterKey, N1Key, N2Key, N3Key, N4Key, N5Key, N6Key, N7Key, N8Key, N9Key, N0Key, DecpntKey, ClearKey. **Method Signature:** `function LockKey (K : Keys) : SysCode;` **Parameters:** [in] `K` Key name **SysCode values returned:** `SysInvalidKey` The key specified is not valid. `SysOK` The function completed successfully.

ProgramDelay
920i
820i
880
1280
	Pauses the user program for the specified time. Delay time is entered in 0.01-second intervals (1/100 seconds, 100 = 1 second).
	Method Signature:
	`procedure ProgramDelay (D : Integer);`
	Parameters:
	[in] `D` `Delay time`
	Example:
	`ProgramDelay(200); -- Pauses the program for 2 seconds.`

ResumeDisplay 920i 820i 1280	Resumes a suspended display. **Method Signature:** `procedure ResumeDisplay`
SetConsecNum 920i 820i 880 1280	Sets `V` to the value of the consecutive number counter. **Method Signature:** `function SetConsecNum (V : Integer) : SysCode;` **Parameters:** [in] `V` Consecutive number **SysCode values returned:** `SysOutOfRange` The value specified is not in the allowed range. The consecutive number is not changed. `SysOK` The function completed successfully.

Table 5-9. System Support Methods (Continued)

Methods	Description
SetDate 920i 820i 880 1280	Sets the date in `DT` to the values specified by `Year`, `Month`, and `Day`. **Method Signature:** `function SetDate (VAR DT : DateTime; VAR Year : Integer; VAR Month : Integer; VAR Day : Integer) : SysCode;` **Parameters:** [out] `DT` DateTime variable name [in] `Year` Year [in] `Month` Month [in] `Day` Day **SysCode values returned:** `SysInvalidRequest` Year, month, or day entry not valid. `SysOK` The function completed successfully.
SetSoftkeyText 920i 820i 1280	Sets the text of softkey `K` (representing F1–F10) to the text specified by `S`. **Method Signature:** `function SetSoftkeyText (K : Integer; S : String) : SysCode;` **Parameters:** [in] `K` Softkey number [in] `S` Softkey text **SysCode values returned:** `SysInvalidRequest` The value specified for K is less than 1 or greater than 10, or does not represent a configured softkey. `SysOK` The function completed successfully.
SetSystemTime 920i 820i 880 1280	Sets the realtime clock to the value specified in `DT`. **Method Signature:** `function SetSystemTime (VAR DT : DateTime);` **Parameters:** [in] `DT` System DateTime
SetTime 920i 820i 880 1280	Sets the time in `DT` to the values specified by `Hour`, `Minute`, and `Second`. **Method Signature:** `function SetTime (VAR DT : DateTime; VAR Hour : Integer; VAR Minute : Integer; VAR Second : Integer) : SysCode;` **Parameters:** [out] `DT` DateTime variable name [in] `Hour` Hour [in] `Minute` Minute [in] `Second` Second **SysCode values returned:** `SysInvalidRequest` Hour or minute entry not valid. `SysOK` The function completed successfully.
SetUID 920i 820i 880 1280	Sets the unit identifier. Note ***Changes made to the UID using the SetUID function are lost when the indicator power is cycled. When power is restored, the UID is reset to the value at the last SAVE/EXIT from configuration mode.*** **Method Signature:** `function SetUID (newid : String);` **Parameters:** [in] `newid` Unit identifier
STick 920i 820i 880 1280	Returns the number of system ticks, in 1/1200th of a second intervals, since the indicator was powered on (1200 = 1 second). **Method Signature:** `function STick : Integer;`
SuspendDisplay 920i 820i 1280	Suspends the display. **Method Signature:** `procedure SuspendDisplay;`

Table 5-9. System Support Methods (Continued)

Methods	Description
SystemTime 920i 820i 880 1280	Returns the current system date and time. **Method Signature:** `function SystemTime : DateTime;` **Parameters:** [in] `K`
Time$ 920i 820i 880 1280	Returns a string representing the system time contained in `DT`. **Method Signature:** `function Time$ (DT : DateTime) : String;`
UnlockKey 920i 820i 880 1280	Enables the specified front panel key. Possible values are: ZeroKey, GrossNetKey, TareKey, UnitsKey, PrintKey, Soft1Key, Soft2Key, Soft3Key, Soft4Key, Soft5Key, NavUpKey, NavRightKey, NavDownKey, NavLeftKey, EnterKey, N1Key, N2Key, N3Key, N4Key, N5Key, N6Key, N7Key, N8Key, N9Key, N0Key, DecpntKey, ClearKey. **Method Signature:** `function UnlockKey (K : Keys) : SysCode;` **Parameters:** [in] `K` Key name **SysCode values returned:** `SysInvalidKey` The key specified is not valid. `SysOK` The function completed successfully.

UnlockKeypad
920i
820i
880
1280
	Enables operation of the entire front panel keypad.
	Method Signature:
	`function UnlockKeypad : SysCode;`
	SysCode values returned:
	`SysPermissionDenied`
	`SysOK` The function completed successfully.

WaitForEntry 920i 820i 880 1280	Similar to GetEntry, WaitForEntry causes the user program to wait for operator input. Wait time is specified in 0.01-second intervals (1/100 seconds); if the wait time is set to zero, the procedure will wait indefinitely or until the **Enter** key is pressed. Note ***The UserEntry handler must be disabled (see DisableHandler on page 43) before using this procedure.*** **Method Signature:** `procedure WaitForEntry (I : Integer);` **Parameters:** [in] `I` Wait time value

Table 5-9. System Support Methods (Continued)

5.3 Serial I/O

Methods	Description

Print
920i
820i
880
1280
	Requests a print operation using the print format specified by `F`. Output is sent to the port specified in the print format configuration.
	Method Signature:
	`function Print (F : PrintFormat) : SysCode;`
	Parameters:
	[in] `F` Print format
	PrintFormat values sent:
	`GrossFmt` Gross format
	`NetFmt` Net format
	`TrWInFmt` Truck weigh-in format
	`TrRegFmt` Truck register format (truck IDs and tare weights)
	`TrWOutFmt` Truck weigh-out format
	`SPFmt` Setpoint format
	`AccumFmt` Accumulator format
	`AuxFmt`*X* Auxiliary format
	SysCode values returned:
	`SysInvalidRequest` The print format specified by `F` does not exist.
	`SysQFull` The request could not be processed because the print queue is full.
	`SysOK` The function completed successfully.
	Example:
	`Fmtout : PrintFormat;`
	…
	`Fmtout := NetFmt`
	`Print (Fmtout);`

Print
880
	Requests a print operation using the print format specified by `F`. Output is sent to the port specified in the print format configuration.
	Method Signature:
	`function Print (F : PrintFormat) : SysCode;`
	Parameters:
	[in] `F` Print format
	PrintFormat values sent:
	`GrossFmt` Gross format
	`NetFmt` Net format
	`SPFmt` Setpoint format
	`AccumFmt` Accumulator format
	`AuxFmt`*X* Auxiliary format
	SysCode values returned:
	`SysInvalidRequest` The print format specified by `F` does not exist.
	`SysQFull` The request could not be processed because the print queue is full.
	`SysOK` The function completed successfully.
	Example:
	`Fmtout : PrintFormat;`
	…
	`Fmtout := NetFmt`
	`Print (Fmtout);`

Table 5-10. Serial I/O Methods

Methods	Description
Send 920i 820i 880 1280	Writes an ASCII representation of the in-memory bytes of the integer or real number specified in <number> to the port specified by `P`. **Method Signature:** `procedure Send (P : Integer; <number>);` **Parameters:** [in] `P` Serial port number [in] <number> The integer or real number to output *Example:* Send (Port1, 123.55); -- sends "<42><F7><19><9A>" (without the quotes or <> symbols) to Port 1 - where: <42> = 42 hex (66 decimal) <F7> = F7 hex (247 decimal) <19> = 19 hex (25 decimal) <9A> = 9A hex (154 decimal) Send (Port1, 4276803); -- sends "<00>ABC" (without the quotes) to Port 1 - where <00> is an ASCII nul

SendChr
920i
820i
880
1280
	Writes the single character specified to the port specified by `P`.
	Method Signature:
	`procedure SendChr (P : Integer; character : Integer);`
	Parameters:
	[in] `P` Serial port number
	[in] character The decimal value of the character to transmit
	Example:
	`SendChr (Port1, 65); -- sends upper-case "A" (decimal 65) to Port 1.`

SendNull
920i
820i
880
1280
	Writes an ASCII null character (decimal 00) to the port specified by `P`.
	Method Signature:
	`procedure SendNull (P : Integer);`
	Parameters:
	[in] `P` Serial port number
	Example:
	`Send (Port1); -- sends` an ASCII `null character (decimal 00) to Port 1.`

SetPrintText
920i
820i
880
1280
	Sets the value of the user-specified format (1-99) to the text specified. The text can be any string of up to 16 characters; if a string of more than 16 characters is specified, nothing is printed.
	Method Signature:
	`function SetPrintText (fmt_num : Integer ; text : String) : Syscode;`
	Parameters:
	[in] `fmt_num` User-specified format number
	[in] `text` Print format text
	SysCode values returned:
	`SysOutOfRange` The text is more than 16 characters.
	`SysInvalidRequest` The specified format number is out of the range of 1-99.
	`SysOK` The function completed successfully.
	Example:
	`SetPrintText(1, "User Pgm. Text");`

StartStreaming
920i
820i
880
1280
	Starts data streaming for the port number specified by `P`. Streaming must be enabled for the port in the indicator configuration.
	Method Signature:
	`function StartStreaming (P : Integer) : SysCode;`
	Parameters:
	[in] `P` Serial port number
	SysCode values returned:
	`SysInvalidPort` The port number specified for `P` is not valid.
	`SysInvalidRequest` The port specified for `P` is not configured for streaming.
	`SysOK` The function completed successfully.
	Example:
	`StartStreaming (1);`

Table 5-10. Serial I/O Methods (Continued)

Methods	Description

StopStreaming
920i
820i
880
1280
	Stops data streaming for the port number specified by `P`.
	Method Signature:
	`function StopStreaming (P : Integer) : SysCode;`
	Parameters:
	[in] `P` Serial port number
	SysCode values returned:
	`SysInvalidPort` The port number specified for `P` is not valid.
	`SysInvalidRequest` The port specified for `P` is not configured for streaming.
	`SysOK` The function completed successfully.
	Example:
	`StopStreaming (1);`

Write
920i
820i
880
1280
	Writes the text specified in the `<arg-list>` to the port specified by `P`. A subsequent `Write` or `WriteLn` operation will begin where this `Write` operation ends; a carriage return is not included at the end of the data sent to the port.
	Note ***This procedure cannot be used to send null characters. Use the SendChr or SendNull procedure to send null characters.***
	Method Signature:
	`procedure Write (P : Integer; <arg-list>);`
	Parameters:
	[in] `P` Serial port number
	[in] `arg_list` Print text
	Example:
	`Write (Port1, "This is a test.");`

WriteLn
920i
820i
880
1280
	Writes the text specified in the `<arg-list>` to the port specified by `P`, followed by a carriage return and a line feed (CR/LF). The line feed (LF) can be suppressed by setting the indicator TERMIN parameter for the specified port to ***CR*** in the SERIAL menu configuration. A subsequent `Write` or `WriteLn` operation begins on the next line.
	Note ***This procedure cannot be used to send null characters. Use the SendChr or SendNull procedure to send null characters.***
	Method Signature:
	`procedure Write (P : Integer; <arg-list>);`
	Parameters:
	[in] `P` Serial port number
	[in] `arg_list` Print text
	Example:
	`WriteLn (Port1, "This is another test.");`

WriteOut 1280	Writes the text specified in the <arg-list> to the connection named by C. A subsequent WriteOut or WriteOutLn operation will begin where this WriteOut operation ends; a carriage return is not included at the end of the data sent to the connection. **Method Signature:** `procedure WriteOut (C : String; <arg-list>);` **Parameters:** [in] C Connection name [in] arg_list Print text
WriteOutLn 1280	Writes the text specified in the <arg-list> to the connection named by C, followed by a carriage return and a line feed (CR/LF). A subsequent WriteOut or WriteOutLn opteration begins on the next line. **Method Signature:** `procedure WriteOutLn (C : String; <arg-list>);` **Parameters:** [in] C Connection name [in] arg_list Print text

Table 5-10. Serial I/O Methods (Continued)

5.4 Program Scale

Methods	Description
SubmitData 920i 1280	Passes data from a user program to the scale processor. Weight, mode, and tare values are provided by the user program; the displayed weight is the weight value minus tare. Gross/net mode is set by the `gn` parameter regardless of whether a tare value is passed. This allows display of a net value when the net is known but gross and tare values are not available. Note ***Because the user program supplies all weight data, weight data acquisition APIs are not valid for program scales. When used with program scales, these APIs (including GetGross, GetNet, GetTare) will typically return a SysCode value of SysInvalidScale. Always check the returned SysCode value of scale-related APIs to ensure valid data.*** **Syntax:** `function SubmitData (scale : Integer; weight : Real; gn : Mode; units : UnitType; tare : Real) : SysCode;` **SysCode values returned:** `SysInvalidScale` The scale is not set up as a program scale. `SysOK` The function completed successfully.
SubmitDSPData	Submit data to a program scale. This function works much like SubmitData() but has fewer parameters. New to this function is the dp : Decimal_Type that allows the program to set the decimal point for the display. The call assumes Gross mode and primary units. **Syntax:** `function SubmitDSPData( scale : integer; weight : real; units : string; dp : Decimal_Type ) : SysCode;` **SysCode values returned:** `SysInvalidScale` The scale is not set up as a program scale. `SysOK` The function completed successfully.

Table 5-11. Program Scale Methods

5.5 Setpoints and Batching

Note ***Unless otherwise stated, when an API with a VAR parameter returns a SysCode value other than SysOK, the VAR parameter is not changed.***

Command	Description

DisableSP
920i
820i
880
1280
	Disables operation of setpoint SP.
	Method Signature:
	`function DisableSP (SP : Integer) : SysCode;`
	Parameters:
	[in] SP Setpoint number
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by SP does not exist.
	`SysBatchRunning` Setpoint SP cannot be disabled while a batch is running.
	`SysInvalidRequest` The setpoint specified by SP cannot be enabled or disabled.
	`SysOK` The function completed successfully.
	Example:
	`DisableSP (4);`

EnableSP
920i
820i
880
1280
	Enables operation of setpoint SP.
	Method Signature:
	`function EnableSP (SP : Integer) : SysCode;`
	Parameters:
	[in] SP Setpoint number
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by SP does not exist.
	`SysBatchRunning` Setpoint SP cannot be enabled while a batch is running.
	`SysInvalidRequest` The setpoint specified by SP cannot be enabled or disabled.
	`SysOK` The function completed successfully.
	Example:
	`EnableSP (4);`

GetBatching Mode 920i 820i 880 1280	Returns the current batching mode (BATCHNG parameter). **Method Signature:** `function GetBatchingMode : BatchingMode;` **BatchingMode values returned:** `Off` Batching mode is off. `Auto` Batching mode is set to automatic. `Manual` Batching mode is set to manual.
GetBatchStatus 920i 820i 880 1280	Sets S to the current batch status. **Method Signature:** `function GetBatchStatus (VAR S : BatchStatus) : SysCode;` **Parameters:** [out] S Batch status **BatchStatus values returned:** `BatchComplete` The batch is complete. `BatchStopped` The batch is stopped. `BatchRunning` A batch routine is in progress. `BatchPaused` The batch is paused. **SysCode values returned:** `SysInvalidRequest` The BATCHNG configuration parameter is set to OFF. `SysOK` The function completed successfully.

Table 5-12. Setpoint and Batching Commands

Command	Description

GetCurrentSP
920i
820i
880
1280
	Sets SP to the number of the current batch setpoint.
	Method Signature:
	`function GetCurrentSP (VAR SP : Integer) : Syscode;`
	Parameters:
	[out] `SP` Setpoint number
	SysCode values returned:
	`SysInvalidRequest` The BATCHNG configuration parameter is set to OFF.
	`SysBatchNotRunning` No batch routine is running.
	`SysOK` The function completed successfully.
	Example:
	`CurrentSP : Integer;`
	…
	`GetCurrentSP (CurrentSP);`
	`WriteLn (Port1, "Current setpoint is", CurrentSP);`

GetSPBand
920i
820i
880
1280
	Sets V to the current band value (BANDVAL parameter) of the setpoint SP.
	Method Signature:
	`function GetSPBand (SP : Integer; V : Real) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[out] `V` Band value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint number specified by SP is less than 1 or greater than the maximum number of setpoints.
	`SysInvalidRequest` The setpoint specified by SP has no band value (BANDVAL) parameter.
	`SysOK` The function completed successfully.
	Example:
	`SP7Bandval : Real;`
	…
	`GetSPBand (7, SP7BAndval);`
	`WriteLn (Port1, "Current Band Value of SP7 is", SP7Bandval);`

GetSPCaptured 920i 820i 880 1280	Sets V to the weight value that satisfied the setpoint SP. **Method Signature:** `function GetSPCaptured (SP : Integer; V : Real) : SysCode;` **Parameters:** [in] `SP` Setpoint number [out] `V` Captured weight value **SysCode values returned:** `SysInvalidSetpoint` The setpoint number specified by SP is less than 1 or greater than the maximum number of setpoints. `SysInvalidRequest` The setpoint is off and has no captured value. `SysOK` The function completed successfully.
GetSPCount 920i 820i 1280	For DINCNT setpoints, sets `Count` to the value specified for setpoint SP. **Method Signature:** `function GetSPCount (SP : Integer; VAR Count : Integer) : SysCode;` **Parameters:** [in] `SP` Setpoint number [out] `Count` Count value **SysCode values returned:** `SysInvalidSetpoint` The setpoint number specified by SP is less than 1 or greater than 100he maximum number of setpoints. `SysInvalidRequest` The specified setpoint is not a DINCNT setpoint. `SysOK` The function completed successfully.

Table 5-12. Setpoint and Batching Commands (Continued)

Command	Description

GetSPDuration
920i
820i
1280
	For time of day (TOD) setpoints, sets `DT` to the current trip duration (DURATION parameter) of setpoint `SP`.
	Method Signature:
	`function GetSPDuration (SP : Integer; VAR DT : DateTime) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[out] `DT` Setpoint trip duration
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no DURATION parameter.
	`SysOK` The function completed successfully.
	Example:
	`SP3DUR : DateTime;`
	…
	`GetSPTime (3, SP3DUR);`
	`WriteLn (Port1, "Current Trip Duration of SP3 is", SP3DUR);`

GetSPHyster
920i
820i
880
1280
	Sets `V` to the current hysteresis value (HYSTER parameter) of the setpoint `SP`.
	Method Signature:
	`function GetSPHyster (SP : Integer; V : Real) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[out] `V` Hysteresis value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no hysteresis HYSTER) parameter.
	`SysOK` The function completed successfully.
	Example:
	`SP5Hyster : Real;`
	…
	`GetSPHyster (5, SP5Hyster);`
	`WriteLn (Port1, "Current Hysteresis Value of SP5 is", SP5Hyster);`

GetSPNSample
920i
820i
	For averaging (AVG) setpoints, sets `N` to the current number of samples (NSAMPLE parameter) of the setpoint `SP`.
	Method Signature:
	`function GetSPNSample (SP : Integer; VAR N : Integer) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[out] `N` Sample value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no NSAMPLE parameter.
	`SysOK` The function completed successfully.
	Example:
	`SP5NS : Integer;`
	…
	`GetSPNSample (5, SP5NS);`
	`WriteLn (Port1, "Current NSample Value of SP5 is", SP5NS);`

GetSPPreact
920i
820i
880
1280
	Sets `V` to the current preact value (PREACT parameter) of the setpoint `SP`.
	Method Signature:
	`function GetSPPreact (SP : Integer; V : Real) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[out] `V` Preact value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no preact (PREACT) parameter.
	`SysOK` The function completed successfully.
	Example:
	`SP2Preval : Real;`
	…
	`GetSPPreact (2, SP2Preval);`
	`WriteLn (Port1, "Current Preact Value of SP2 is", SP2Preval);`

Table 5-12. Setpoint and Batching Commands (Continued)

Command	Description

GetSPPreCount
920i
820i
1280
	Sets `Count` to the preact count value (PCOUNT parameter) of DINCNT type setpoint `SP`.
	Method Signature:
	`function GetSPPreCount (SP : Integer; Count : Integer) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[out] `Count` Preact count value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` is not DINCNT type parameter.
	`SysOK` The function completed successfully.
	Example:
	`SP3PCount : Integer;`
	…
	`GetSPPreCount (3, SP3PCount);`
	`WriteLn (Port1, "Current Preact Learn Value of SP3 is", SP3PCount);`

GetSPTime
920i
820i
1280
	For time of day (TOD) setpoints, sets `DT` to the current trip time (TIME parameter) of the setpoint `SP`.
	Method Signature:
	`function GetSPTime (SP : Integer; VAR DT : DateTime) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[out] `DT` Current setpoint trip time
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no TIME parameter.
	`SysOK` The function completed successfully.
	Example:
	`SP2TIME : DateTime;`
	…
	`GetSPTime (2, SP2TIME);`
	`WriteLn (Port1, "Current Trip Time of SP2 is", SP2TIME);`

GetSPValue
920i
820i
880
1280
	Sets `V` to the current value (VALUE parameter) of the setpoint `SP`.
	Method Signature:
	`function GetSPValue (SP : Integer; VAR V : Real) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[out] `V` Setpoint value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no VALUE parameter.
	`SysOK` The function completed successfully.
	Example:
	`SP4Val : Real;`
	…
	`GetSPValue (4, SP4Val);`
	`WriteLn (Port1, "Current Value of SP4 is", SP4Val);`

GetSPVover
920i
820i
	For checkweigh (CHKWEI) setpoints, sets `V` to the current overrange value (VOVER parameter) of the setpoint `SP`.
	Method Signature:
	`function GetSPVover (SP : Integer; VAR V : Real) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[out] `V` Overrange value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no VOVER parameter.
	`SysOK` The function completed successfully.
	Example:
	`SP3VOR : Real;`
	…
	`GetSPVover (3, SP3VOR);`
	`WriteLn (Port1, "Current Overrange Value of SP3 is", SP3VOR);`

Table 5-12. Setpoint and Batching Commands (Continued)

Command	Description

GetSPVunder
920i
820i
	For checkweigh (CHKWEI) setpoints, sets `V` to the current underrange value (VUNDER parameter) of the setpoint `SP`.
	Method Signature:
	`function GetSPVunder (SP : Integer; VAR V : Real) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[out] `V` Underrange value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no VUNDER parameter.
	`SysOK` The function completed successfully.
	Example:
	`SP4VUR : Real;`
	…
	`GetSPVunder (4, SP4VUR);`
	`WriteLn (Port1, "Current Underrange Value of SP4 is", SP4VUR);`

PauseBatch 920i 820i 880 1280	Initiates a latched pause of a running batch process. **Method Signature:** `function PauseBatch : SysCode;` **SysCode values returned:** `SysPermissionDenied` The BATCHNG configuration parameter is set to OFF. `SysBatchRunning` No batch routine is running. `SysOK` The function completed successfully.
ResetBatch 920i 820i 880 1280	Terminates a running, stopped, or paused batch process and resets the batch system. **Method Signature:** `function ResetBatch : SysCode;` **SysCode values returned:** `SysPermissionDenied` The BATCHNG configuration parameter is set to OFF. `SysBatchRunning` No batch routine is running. `SysOK` The function completed successfully.
SetBatching Mode 920i 820i 880 1280	Sets the batching mode (BATCHNG parameter) to the value specified by `M`. **Method Signature:** `function SetBatchingMode (M : BatchingMode) : SysCode;` **Parameters:** [in] `SP` Setpoint number [in] `M` Batching mode **BatchingMode values sent:** `Off` Batching mode is off. `Auto` Batching mode is set to automatic. `Manual` Batching mode is set to manual. **SysCode values returned:** `SysInvalidMode` The batching mode specified by `M` is not valid. `SysOK` The function completed successfully.

SetSPBand
920i
820i
880
1280
	Sets the band value (BANDVAL parameter) of setpoint `SP` to the value specified by `V`.
	Method Signature:
	`function SetSPBand (SP : Integer; V : Real) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[in] `V` Band value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no band value (BANDVAL) parameter.
	`SysBatchRunning` The value cannot be changed because a batch process is currently running.
	`SysOK` The function completed successfully.
	Example:
	`SP7Bandval : Real;`
	…
	`SP7Bandval := 10.0`
	`SetSPBand (7, SP7Bandval);`

Table 5-12. Setpoint and Batching Commands (Continued)

Command	Description
SetSPCount 920i 820i 1280	For DINCNT setpoints, sets `the VALUE parameter` of setpoint `SP` to the value specified by `Count`. **Method Signature:** `function SetSPCount (SP : Integer; Count : Integer) : SysCode;` **Parameters:** [in] `SP` Setpoint number [in] `Count` Count value **SysCode values returned:** `SysInvalidSetpoint` The setpoint number specified by `SP` is less than 1 or greater than the maximum number of setpoints. `SysInvalidRequest` The specified setpoint is not a DINCNT setpoint. `SysOK` The function completed successfully.

SetSPDuration
920i
820i
1280
	For time of day (TOD) setpoints, sets the trip duration (DURATION parameter) of setpoint `SP` to the value specified by `DT`.
	Method Signature:
	`function SetSPDuration (SP : Integer; DT : DateTime) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[in] `DT` Setpoint trip duration
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no DURATION parameter.
	`SysBatchRunning` The value cannot be changed because a batch process is currently running.
	`SysOutOfRange` The value specified for `DT` is not in the allowed range for setpoint `SP`.
	`SysOK` The function completed successfully.
	Example:
	`SP3DUR : DateTime;`
	…
	`SP3DUR := 00:3:15`
	`SetSPDuration (3, SP3DUR);`

SetSPHyster
920i
820i
880
1280
	Sets the hysteresis value (HYSTER parameter) of setpoint `SP` to the value specified by `V`.
	Method Signature:
	`function SetSPHyster (SP : Integer; V : Real) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[in] `V` Hysteresis value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no hysteresis (HYSTER) parameter.
	`SysBatchRunning` The value cannot be changed because a batch process is currently running.
	`SysOK` The function completed successfully.
	Example:
	`SP5Hyster : Real;`
	…
	`SP5Hyster := 15.0;`
	`SetSPHyster (5, SP5Hyster);`

Table 5-12. Setpoint and Batching Commands (Continued)

Command	Description

SetSPNSample
920i
820i
	For averaging (AVG) setpoints, sets the number of samples (NSAMPLE parameter) of setpoint `SP` to the value specified by `N`.
	Method Signature:
	`function SetSPNSample (SP : Integer; N : Integer) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[in] `N` Sample value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no NSAMPLE parameter.
	`SysBatchRunning` The value cannot be changed because a batch process is currently running.
	`SysOutOfRange` The value specified for `N` is not in the allowed range for setpoint `SP`.
	`SysOK` The function completed successfully.
	Example:
	`SP5NS : Integer;`
	…
	`SP5NS := 10`
	`SetSPNSample (5, SP5NS);`

SetSPPreact
920i
820i
880
1280
	Sets the preact value (PREACT parameter) of setpoint `SP` to the value specified by `V`.
	Method Signature:
	`function SetSPPreact (SP : Integer; V : Real) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[in] `V` Preact value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no preact (PREACT) parameter.
	`SysBatchRunning` The value cannot be changed because a batch process is currently running.
	`SysOK` The function completed successfully.
	Example:
	`SP2PreVal : Real;`
	…
	`SP2PreVal := 30.0;`
	`SetSPPreact (2, SP2PreVal);`

SetSPPreCount
920i
820i
880
1280
	Sets the preact count value (PCOUNT parameter) of setpoint `SP` to the value specified by `Count`.
	Method Signature:
	`function SetSPPreCount (SP : Integer; Count : Integer) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[in] `Count` Preact count value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` is not type DINCNT or Count is less than 0.
	`SysOK` The function completed successfully.
	Example:
	`SP3PCount : Integer;`
	…
	`SP3Pcount := 4;`
	`SetSPPreCount (3, SP3PCount);`

Table 5-12. Setpoint and Batching Commands (Continued)

Command	Description

SetSPTime
920i
820i
1280
	`For time of day (TOD) setpoints, sets the trip time (TIME parameter) of setpoint SP to the value specified by DT.`
	Method Signature:
	`function SetSPTime (SP : Integer; DT : DateTime) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[in] `DT` Setpoint trip time
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no TIME parameter.
	`SysBatchRunning` The value cannot be changed because a batch process is currently running.
	`SysOutOfRange` The value specified for `DT` is not in the allowed range for setpoint `SP`.
	`SysOK` The function completed successfully.
	Example:
	`SP2TIME : DateTime;`
	…
	`SP2TIME := 08:15:00`
	`SetSPTime (2, SP2TIME);`

SetSPValue
920i
820i
880
1280
	Sets the value (VALUE parameter) of setpoint `SP` to the value specified by `V`.
	Method Signature:
	`function SetSPValue (SP : Integer; V : Real) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[in] `V` Setpoint value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no VALUE parameter.
	`SysBatchRunning` The value cannot be changed because a batch process is currently running.
	`SysOutOfRange` The value specified for `V` is not in the allowed range for setpoint `SP`.
	`SysOK` The function completed successfully.
	Example:
	`SP4Val : Real;`
	…
	`SP4Val := 350.0;`
	`SetSPValue (4, SP4Val);`

SetSPVover
920i
820i
	For checkweigh (CHKWEI) setpoints, sets the overrange value (VOVER parameter) of setpoint `SP` to the value specified by `V`.
	Method Signature:
	`function SetSPVover (SP : Integer; V : Real) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[in] `V` Overrange value
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by `SP` does not exist.
	`SysInvalidRequest` The setpoint specified by `SP` has no VOVER parameter.
	`SysOK` The function completed successfully.
	Example:
	`SP3VOR : Real;`
	…
	`SP3VOR := 35.5`
	`SetSPVover (3, SP3VOR);`

Table 5-12. Setpoint and Batching Commands (Continued)

Command	Description

SetSPVunder
920i
820i
	For checkweigh (CHKWEI) setpoints, sets the underrange value (VUNDER parameter) of setpoint SP to the value specified by V.
	Method Signature:
	`function SetSPVunder (SP : Integer; V : Real) : SysCode;`
	Parameters:
	[in] `SP` Setpoint number
	[in] `V` Underrange
	SysCode values returned:
	`SysInvalidSetpoint` The setpoint specified by SP does not exist.
	`SysInvalidRequest` The setpoint specified by SP has no VUNDER parameter.
	`SysOK` The function completed successfully.
	Example:
	`SP4VUR : Real;`
	…
	`SP4VUR := 26.4`
	`SetSPVunder (4, SP4VUR);`

StartBatch 920i 820i 880 1280	Starts or resumes a batch run. **Method Signature:** `function StartBatch : SysCode;` **SysCode values returned:** `SysPermissionDenied` The BATCHNG configuration parameter is set to OFF. `SysBatchRunning` A batch process is already in progress. `SysOK` The function completed successfully.
StopBatch 920i 820i 880 1280	Stops a currently running batch. **Method Signature:** `function StopBatch : SysCode;` **SysCode values returned:** `SysPermissionDenied` The BATCHNG configuration parameter is set to OFF. `SysBatchNotRunning` No batch process is running. `SysOK` The function completed successfully.

Table 5-12. Setpoint and Batching Commands (Continued)

5.6 Digital I/O Control

In the following digital I/O control functions, slot 0 represents the digital I/O available on the CPU board of the indicator. The 920i supports 6 onboard bits, the 880 four, and the 820 and 1280 both support 8. Digital I/O on expansion boards each support 24 bits.

Command	Description

GetDigin
920i
820i
880
1280
	Sets V to the value of the digital input assigned to slot S, bit D. GetDigin sets the value of V to 0 if the input is on, to 1 if the input is off. Note that the values returned are the reverse of those used when setting an output with the SetDigout function.
	Method Signature:
	`function GetDigin (S : Integer; D : Integer; VAR V : Integer) : SysCode;`
	Parameters:
	[in] `S` Slot number
	[in] `D` Bit number
	[out] `D` Digital input status
	SysCode values returned:
	`SysInvalidRequest` The slot and bit assignment specified is not a valid digital input.
	`SysOK` The function completed successfully.
	Example:
	`DIGINS0B3 : Integer;`
	…
	`GetDigin (0, 3, DIGINS0B3);`
	`WriteLn (Port1, "Digin S0B3 status is", DIGINS0B3);`

Table 5-13. Digital I/O Control Commands

Command	Description

GetDigout
920i
820i
880
1280
	Sets `V` to the value of the digital output assigned to slot `S`, bit `D`. GetDigout sets the value of `V` to 0 if the output is off, to 1 if the output is on.
	Method Signature:
	`function GetDigout (S : Integer; D : Integer; VAR V : Integer) : SysCode;`
	Parameters:
	[in] `S` Slot number
	[in] `D` Bit number
	[out] `D` Digital output status
	SysCode values returned:
	`SysInvalidRequest` The slot and bit assignment specified is not a valid digital output.
	`SysOK` The function completed successfully.
	Example:
	`DIGOUTS0B2 : Integer;`
	…
	`GetDigout (0, 2, DIGOUTS0B2);`
	`WriteLn (Port1, "Digout S0B2 status is", DIGOUTS0B2);`

SetDigout
920i
820i
880
1280
	Sets value of the digital output assigned to slot `S`, bit `D`, to the value specified by `V`. Set `V` to 1 to turn the specified output on; set `V` to 0 to turn the output off.
	Method Signature:
	`function SetDigout (S : Integer;  D : Integer; V : Integer) : SysCode;`
	Parameters:
	[in] `S` Slot number
	[in] `D` Bit number
	[in] `D` Digital output status
	SysCode values returned:
	`SysInvalidRequest` The slot and bit assignment specified is not a valid digital output.
	`SysOutOfRange` The value `V` must be 0 (inactive) or 1 (active).
	`SysOK` The function completed successfully.
	Example:
	`DIGOUTS0B2 : Integer;`
	…
	`DIGOUTS0B2 := 0;`
	`SetDigout (0, 2, DIGOUTS0B2);`

Table 5-13. Digital I/O Control Commands (Continued)

5.7 Fieldbus Data

Methods	Description

GetFBStatus
920i
820i
	Returns the status word for the specified fieldbus. See the fieldbus *Installation and Programming* manual for a description of the status word format.
	Method Signature:
	`function GetFBStatus (fieldbus_no : Integer;  scale_no : Integer; VAR status : Integer) : SysCode;`
	Parameters:
	[in] `fieldbus_no` Fieldbus number
	[in] `scale_no` Scale number
	[out] `status` Fieldbus status
	SysCode values returned:
	`SysInvalidRequest`
	`SysOK` The function completed successfully.

GetImage
920i
820i
	For integer data, GetImage returns the content of the BusImage for the specified fieldbus.
	Method Signature:
	`function GetImage (fieldbus_no : Integer; VAR data : BusImage) : SysCode;`
	Parameters:
	[in] `fieldbus_no` Fieldbus number
	[out] `BusImage` Bus image
	SysCode values returned:
	`SysInvalidRequest`
	`SysOK` The function completed successfully.

Table 5-14. Fieldbus Methods

Methods	Description

GetImageReal
920i
820i
	For real data, GetImage returns the content of the BusImageReal for the specified fieldbus.
	Method Signature:
	`function GetImageReal (fieldbus_no : Integer; VAR data : BusImageReal) : SysCode;`
	Parameters:
	[in] `fieldbus_no` Fieldbus number
	[out] `BusImageReal` Bus image
	SysCode values returned:
	`SysInvalidRequest`
	`SysOK` The function completed successfully.

SetImage
920i
820i
	`For integer data, SetImage sets the content of the BusImage for the specified fieldbus.`
	Method Signature:
	`function SetImage (fieldbus_no : Integer; data : BusImage) : SysCode;`
	Parameters:
	[in] `fieldbus_no` Fieldbus number
	[in] `BusImage` Bus image
	SysCode values returned:
	`SysInvalidRequest`
	`SysOK` The function completed successfully.

SetImageReal
920i
820i
	For real data, SetImageReal sets the content of the BusImageReal for the specified fieldbus.
	Method Signature:
	`function SetImage (fieldbus_no : Integer; data : BusImageReal) : SysCode;`
	Parameters:
	[in] `fieldbus_no` Fieldbus number
	[in] `BusImageReal` Bus image
	SysCode values returned:
	`SysInvalidRequest`
	`SysOK`The function completed successfully.

Table 5-14. Fieldbus Methods

5.8 Analog Output Operation

Methods	Description
SetAlgout 920i 820i 880 1280	Sets the analog output card in slot `S` to the percentage `P`. Negative `P` values are set to zero; values greater than 100.0 are set to 100.0. **Method Signature:** `function SetAlgout (S : Integer;  P : Real) : SysCode;` **Parameters:** [in] `S` Slot number [in] `P` Analog output percentage value **SysCode values returned:** `SysInvalidPort` The specified slot (`S`) is not a valid analog output. `SysInvalidRequest` The analog output is not configured from program control. `SysOK` The function completed successfully.

Table 5-15. Analog Output Operation Methods

5.9 Pulse Input Operation

Methods	Description
ClearPulseCount 920i 820i 1280	Sets the pulse count of the pulse input card in slot `S` to zero. **Method Signature:** `function ClearPulseCount (S : Integer) : SysCode;` **Parameters:** [in] `S` Slot number **SysCode values returned:** `SysInvalidCounter` The specified counter (S) is not a valid pulse input. `SysOK` The function completed successfully.
PulseCount 920i 820i 1280	Sets `C` to the current pulse count of the pulse input card in slot `S`. **Method Signature:** `function PulseCount (S : Integer;  VAR C : Integer) : SysCode;` **Parameters:** [in] `S` Slot number [out] `C` Current pulse count **SysCode values returned:** `SysInvalidCounter` The specified counter (S) is not a valid pulse input. `SysOK` The function completed successfully.
PulseRate 920i 820i	Sets `R` to the current pulse rate (in pulses per second) of the pulse input card in slot `S`. **Method Signature:** `function PulseRate (S : Integer;  VAR R : Integer) : SysCode;` **Parameters:** [in] `S` Slot number [out] `C` Current pulse rate **SysCode values returned:** `SysInvalidCounter` The specified counter (S) is not a valid pulse input. `SysOK` The function completed successfully.

Table 5-16. Pulse Input Operation Methods

Note ***When configuring a 1280 Enterprise Indicator with a pulse input card installed in the controller assembly, it should be configured onboard using the eight digital IO points.***

5.10 Display Operation

Methods	Description
ClosePrompt 920i 820i 880 1280	Closes a prompt opened by the PromptUser function. **Method Signature:** `procedure ClosePrompt;`
DisplayStatus 920i 820i 880 1280	Displays the string `msg` in the front panel status message area. The length of string `msg` should not exceed 32 characters. **Note** ***On the 880 indicator, the message will scroll across the available six digit display.*** **Method Signature:** `procedure DisplayStatus (msg : String);` **Parameters:** [in] `msg` Display text
GetEntry 920i 820i 880 1280	Retrieves the user entry from a programmed prompt. **Method Signature:** `function GetEntry : String;`

PromptUser
920i
820i
880
1280
	`Opens the alpha entry box and places the string msg in the user prompt area.`
	Method Signature:
	`function PromptUser (msg : String) : SysCode;`
	Parameters:
	[in] `msg` Prompt text
	SysCode values returned:
	`SysRequestFailed` The prompt could not be opened.
	`SysOK` The function completed successfully.

SelectScreen 920i 820i 1280	Selects the configured screen, `N`, to show on the indicator display. **Method Signature:** `function SelectScreen (N : Integer) : SysCode;` **Parameters:** [in] `N` Screen number **SysCode values returned:** `SysInvalidRequest` The value specified for `N` is less than 1 or greater than 10. `SysOK` The function completed successfully.
SetEntry 920i 820i 880 1280	Sets the user entry for a programmed prompt. This procedure can be used to provide a default value for entry box text when prompting the operator for input. Up to 1000 characters can be specified. **Note** ***For the 1280, call SetEntry before opening the prompt with PromptUser.*** **Method Signature:** `procedure SetEntry (S : String);`

Table 5-17. Display Operation Methods

5.11 Display Programming

Methods	Description
ClearGraph 920i	Clears a graph by setting all elements of a DisplayImage array to zero. **Method Signature:** `procedure ClearGraph (VAR graph_array : DisplayImage);` **Parameters:** [out] `graph_array` Graph identifier
DrawGraphic 920i	Displays or erases a graphic defined in the bitmap.iri file incorporated into the user program source (.src) file. See Section 6.6 on page 90 for more information about display programming. **Method Signature:** `function DrawGraphic (gr_num : Integer; x_start : Integer; y_start : Integer; bitmap : DisplayImage; color : Color_type) : SysCode;` **Parameters:** [in] `gr_num` Graphic number [in] `x_start` X-axis starting pixel location [in] `y_start` Y-axis starting pixel location [in] `bitmap` Graphic bitmap [in] `color` Color type **SysCode values returned:** `SysDeviceError` The value specified for `gr_num` is greater than 100. `SysOK` The function completed successfully.

GraphCreate
920i
	Assigns storage and defines the graph display type for use by other graphing functions.
	Method Signature:
	`function GraphCreate (graphic_no : Integer; bitmap : DisplayImage; color : Color_type; kind : GraphType) : SysCode;`
	Parameters:
	[in] `graphic_no`Graphic number
	[in] `bitmap` Bitmap
	[in] `color` Graphic color
	[in] `kind` Graphic kind
	SysCode values returned:
	`SysInvalidRequest` The DisplayImage specified by `bitmap` does not exist.
	`SysOK` The function completed successfully.
	Example:
	`G_Graph1 : DisplayImage;`
	`  result : Syscode;`
	`begin`
	`  result := GraphCreate(1, G_Graph1, Black, Bar);`
	`  if result = SysOK then`
	`    result :=GraphInit(71,30,60,110,240);`
	`  end if;`
	`end;`

Table 5-18. Display Programming Methods

Methods	Description

GraphInit
920i
	Sets the location of the graph on the display. `x_start` and `y_start` values specify the distance, in pixels, from top left corner of the display at which the top left corner of the graph is shown. `height` and `width` specify the graph size, in pixels. (Full display size is 240 pixels high by 320 pixels wide.)
	Method Signature:
	`function GraphInit (graphic_no : Integer; x_start : Integer; y_start : Integer; height : Integer; width : Integer) : SysCode;`
	Parameters:
	[in] `graphic_no` Graphic number
	[in] `x_start` X-axis starting pixel location
	[in] `y_start` Y-axis starting pixel location
	[in] `height` Graphic height
	[in] `width` Graphic width
	SysCode values returned:
	`SysInvalidRequest` The DisplayImage specified by `bitmap` does not exist.
	`SysOutOfRange` Specified parameters exceed display height or width, or are too small to accommodate the graphic.
	`SysDeviceError` Internal error
	`SysOK` The function completed successfully.
	Example:
	`G_Graph1 : DisplayImage;`
	  `result : Syscode;`
	`begin`
	  `result := GraphCreate(1, G_Graph1, Black, Bar);`
	  `if result = SysOK then`
	    `result :=GraphInit(71,30,60,110,240);`
	  `end if;`
	`end;`

GraphPlot
920i
	Plots the graph previously set up using the GraphCreate, GraphInit, and GraphScale functions. The graph appears as a histogram: each GraphPlot call places a bar or line at the right edge of the graph, moving values from previous calls to the left. The width of the bar, in pixels, is specified by `width` parameter. The maximum width value is 8; larger values are reduced to 8. If the `y_value` is beyond the bounds set by GraphScale, the bar is plotted to the maximum or minimum value.
	Method Signature:
	`function GraphPlot (graphic_no : Integer; y_value : Real; width : Integer; color : Color_type) : SysCode;`
	Parameters:
	[in] `graphic_no` Graphic number
	[in] `y_value` Pixel height of histogram
	[in] `color` Color type
	[in] `width` Pixel width of moving bar
	SysCode values returned:
	`SysInvalidRequest` Graph not initialized.
	`SysOK` The function completed successfully.
	Example:
	  `result : Syscode;`
	  `weight : real;`
	
	`begin`
	  `GetGross(1,Primary,weight);`
	  `result := GraphPlot(1, weight, 1, Black);`
	`end;`

Table 5-18. Display Programming Methods (Continued)

Methods	Description

GraphScale
920i
	Sets the minimum and maximum x and y values for a graph. Currently, only the y values are used for the histogram displays; x values are reserved for future use, but must be present in the call.
	Method Signature:
	`function GraphScale (graphic_no : Integer; x_min : Real; x_max : Real; y_min : Real; y_max : Real) : SysCode;`
	Parameters:
	[in] `graphic_no` Graphic number
	[in] `x_min` Minimum x-axis value
	[in] `x_max` Maximum x-axis value)
	[in] `y_min` Minimum y-axis value
	[in] `y-max` Maximum y-axis value
	SysCode values returned:
	`SysInvalidRequest` Graph not initialized.
	`SysOutOfRange` A min value (`x_min` or `y_min`) is greater than its specified max value.
	`SysOK` The function completed successfully.
	Example:
	`GraphScale(1, 10.0, 50000.0, 0.0, 10000.0);`

SetBargraph Level 920i 1280	Sets the displayed level of bargraph widget `W` to the percentage (0–100%) specified by `Level`. **Method Signature:** `function SetBargraphLevel (W : Integer; Level : Integer) : SysCode;` **Parameters:** [in] `W` Bargraph widget number [in] `Level` Bargraph widget level **SysCode values returned:** `SysInvalidWidget` The bargraph widget specified by `W` does not exist. `SysOK` The function completed successfully.
SetLabelText 920i 1280	Sets the text of label widget `W` to `S`. **Method Signature:** `function SetLabelText (W : Integer; S : String) : SysCode;` **Parameters:** [in] `W` Label widget number [in] `S` Label widget text **SysCode values returned:** `SysInvalidWidget` The label widget specified by `W` does not exist. `SysOK` The function completed successfully.
SetNumericValue 920i	Sets the value of numeric widget `W` to `V`. **Method Signature:** `function SetNumericValue (W : Integer; V : Real) : SysCode;` **Parameters:** [in] `W` Numeric widget number [in] `V` Numeric widget value **SysCode values returned:** `SysInvalidWidget` The numeric widget specified by `W` does not exist. `SysOK` The function completed successfully.
SetSymbolState 920i 1280	Sets the state of symbol widget `W` to `S`. The widget state determines the variant of the widget symbol displayed. All widgets have at least two states (values 1 and 2); some have three (3). See 1280 and 920i Technical Manuals for descriptions of the symbol widget states. **Method Signature:** `function SetSymbolState (W : Integer; S : Integer) : SysCode;` **Parameters:** [in] `W` Symbol widget number [in] `S` Symbol widget state **SysCode values returned:** `SysInvalidWidget` The symbol widget specified by `W` does not exist. `SysOK` The function completed successfully.

Table 5-18. Display Programming Methods (Continued)

Methods	Description
SetWidget Visibility 920i 1280	Sets the visibility state of widget W to V. **Method Signature:** `function SetWidgetVisibility (W : Integer; V : OnOffType) : SysCode;` **Parameters:** [in] `W` Widget number [in] `V` Widget visibility **SysCode values returned:** `SysInvalidWidget` The widget specified by `W` does not exist. `SysOK` The function completed successfully.
SetWidgetColor 1280	Sets the color of widget W to C. `A set widget color uses HTML RGB style. See Section 5.11.1` **Method Signature:** `function SetWidgetColor (W : Integer; C : String) : SysCode` **Parameters:** [in] `W` Widget number [in] `C` Widget color **SysCode values returned:** SysInvalidWidget Requested widget could not be found SysInvalidRequest No string provided for color parameter SysOk The function completed successfully
SetSymbolColor 1280	Sets the color of symbol widget W to C. Integer Range is 1-16 characters. **Method Signature:** `function SetSymbolColor (W : Integer; C : Integer) : SysCode` **Parameters:** [in] `W` Widget number [in] `C` Symbol color **SysCode values returned:** SysInvalidWidget Requested widget could not be found SysInvalidRequest Invalid color SysOk The function completed successfully

Table 5-18. Display Programming Methods (Continued)

5.11.1 Setting Widget Colors

SetWidgetColor(1, “#RRGGBB”);

Hexadecimal color values are supported in all browsers and is specified with: #RRGGBB.

- RR = hex value for red 00-FF (0-255)
- GG = hex value for green 00-FF (0-255)
- BB = hex value for blue 00-FF (0-255)

FF – specifies the intensity of the color.

Example:

#0000FF is displayed as blue, because the blue component is set to its highest value (FF) and the others are set to 00.

The list of colors for the symbols are shown in Table 5-19.

The following link explains web colors and supplies more information about the use of web colors.

https://en.wikipedia.org/wiki/Web_colors

This link accesses the vast number of hex colors that are supported by all browsers.

http://www.w3schools.com/colors/colors_names.asp

1	Black
2	Dark Red
3	Red
4	Pinkl
5	Teal
6	Green
7	Bright Green
8	Turquoise
9	Dark Blue
10	Violet
11	Blue
12	Light Grey
13	Dark Grey
14	Dark Yellow
15	Yellow
16	White

Table 5-19. Symbol Colors

5.12 Database Operation

Methods	Description
<DB>.Add 920i 880 1280	Adds a record to the referenced database. Using this function invalidates any previous sort operation. **Method Signature:** `function <DB>.Add : SysCode;` **SysCode values returned:** `SysNoSuchDatabase` The referenced database cannot be found. `SysDatabaseFull` There is no space in the specified database for this record. `SysOK` The function completed successfully.
<DB>.Clear 920i 880 1280	Clears all records from the referenced database. **Method Signature:** `function <DB>.Clear : SysCode;` **SysCode values returned:** `SysNoSuchDatabase` The referenced database cannot be found. `SysOK` The function completed successfully.
<DB>.Delete 920i 880 1280	Deletes the current record from the referenced database. Using this function invalidates any previous sort operation. **Method Signature:** `function <DB>.Delete : SysCode;` **SysCode values returned:** `SysNoSuchDatabase` The referenced database cannot be found. `SysNoSuchRecord` The requested record is not contained in the database. `SysOK` The function completed successfully.
*The following <DB.Find> functions allow a database to be searched. Column **I** is an alias for the field name, generated by the **Generate iRev import** file operation. The value to be matched is set in the working database record, in the field corresponding to column **I**, before a call to <DB>.FindFirst or <DB>.FindLast.*	
<DB>.FindFirst 920i 880 1280	Finds the first record in the referenced database that matches the contents of `<DB>` column `I`. **Method Signature:** `function <DB>.FindFirst (I : Integer) : SysCode;` **SysCode values returned:** `SysNoSuchDatabase` The referenced database cannot be found. `SysNoSuchRecord` The requested record is not contained in the database. `SysNoSuchColumn` The column specified by `I` does not exist. `SysOK` The function completed successfully.
<DB>.FindLast 920i 880 1280	Finds the last record in the referenced database that matches the contents of `<DB>` column `I`. **Method Signature:** `function <DB>.FindLast (I : Integer) : SysCode;` **SysCode values returned:** `SysNoSuchDatabase` The referenced database cannot be found. `SysNoSuchRecord` The requested record is not contained in the database. `SysNoSuchColumn` The column specified by `I` does not exist. `SysOK` The function completed successfully.
<DB>.FindNext 920i 880 1280	Finds the next record in the referenced database that matches the criteria of a previous FindFirst or FindLast operation. **Method Signature:** `function <DB>.FindNext : SysCode;` **SysCode values returned:** `SysNoSuchDatabase` The referenced database cannot be found. `SysNoSuchRecord` The requested record is not contained in the database. `SysOK` The function completed successfully.
<DB>.FindPrev 920i 880 1280	Finds the previous record in the referenced database that matches the criteria of a previous FindFirst or FindLast operation. **Method Signature:** `function <DB>.FindLast : SysCode;` **SysCode values returned:** `SysNoSuchDatabase` The referenced database cannot be found. `SysNoSuchRecord` The requested record is not contained in the database. `SysOK` The function completed successfully.

Table 5-20. Database Communication Methods

Methods	Description
<DB>.GetFirst 920i 880 1280	Retrieves the first logical record from the referenced database. **Method Signature:** `function <DB>.GetFirst : SysCode;` **SysCode values returned:** `SysNoSuchDatabase` The referenced database cannot be found. `SysNoSuchRecord` The requested record is not contained in the database. `SysOK` The function completed successfully.

<DB>.GetLast
920i
880
1280
	`Retrieves the last logical record from the referenced database.`
	Method Signature:
	`function <DB>.GetLast : SysCode;`
	SysCode values returned:
	`SysNoSuchDatabase` The referenced database cannot be found.
	`SysNoSuchRecord` The requested record is not contained in the database.
	`SysOK` The function completed successfully.

<DB>.GetNext 920i 880 1280	Retrieves the next logical record from the referenced database. **Method Signature:** `function <DB>.GetNext : SysCode;` **SysCode values returned:** `SysNoSuchDatabase` The referenced database cannot be found. `SysNoSuchRecord` The requested record is not contained in the database. `SysOK` The function completed successfully.
<DB>.GetPrev 920i 880 1280	Retrieves the previous logical record from the referenced database. **Method Signature:** `function <DB>.GetPrev : SysCode;` **SysCode values returned:** `SysNoSuchDatabase` The referenced database cannot be found. `SysNoSuchRecord` The requested record is not contained in the database. `SysOK` The function completed successfully.
<DB>.Sort 920i 880 1280	Sorts database `<DB>` into ascending order based on the contents of column `I`. The sort table supports a maximum of 30 000 elements. Databases with more than 30 000 records cannot be sorted. The 880 has a maximum sort of 15000 elements. **Method Signature:** `function <DB>.Sort (I : Integer) : SysCode;` **Parameters:** [in] `I` Column number to sort by. **SysCode values returned:** `SysNoSuchDatabase` The referenced database cannot be found. `SysNoSuchRecord` The requested record is not contained in the database. `SysOK` The function completed successfully.
<DB>.Update 920i 880 1280	Updates the current record in the referenced database with the contents of `<DB>`. Using this function invalidates any previous sort operation. **Method Signature:** `function <DB>.Update : SysCode;` **SysCode values returned:** `SysNoSuchDatabase` The referenced database cannot be found. `SysNoSuchRecord` The requested record is not contained in the database. `SysOK` The function completed successfully.

Table 5-20. Database Communication Methods (Continued)

5.13 Timer Control

Thirty-two timers, configurable as either continuous or one-shot timers, can be used to generate events at some time in the future. The shortest interval for which a timer can be set is 10 ms.

Methods	Description
ResetTimer 920i 820i 880 1280	Resets the value of timer `T` (1–32) by stopping the timer, setting the timer mode to TimerOneShot, and setting the timer time-out to 0. **Method Signature:** `function ResetTimer (T : Integer) : Syscode;` **Parameters:** [in] `T` Timer number **SysCode values returned:** `SysInvalidTimer` The timer specified by `T` is not a valid timer. `SysOK` The function completed successfully.
ResumeTimer 920i 820i 880 1280	Restarts a stopped timer `T` (1–32) from its stopped value. **Method Signature:** `function ResumeTimer (T : Integer) : Syscode;` **Parameters:** [in] `T` Timer number **SysCode values returned:** `SysInvalidTimer` The timer specified by `T` is not a valid timer. `SysOK` The function completed successfully.
SetTimer 920i 820i 880 1280	Sets the time-out value of timer `T` (1–32). Timer values are specified in 0.01-second intervals (1= 10 ms, 100 = 1 second). For one-shot timers, the SetTimer function must be called again to restart the timer once it has expired. **Method Signature:** `function SetTimer (T : Integer ; V : Integer) : Syscode;` **Parameters:** [in] `T` Timer number [in] `V` Timer value **SysCode values returned:** `SysInvalidRequest` The specified time-out value is less than 0. `SysInvalidTimer` The timer specified by `T` is not a valid timer. `SysOK` The function completed successfully.

SetTimerDigout
920i
820i
880
1280
	Used to provide precise control of state changes for timers using TimerDigoutOff or TimerDigoutOn modes. The state of the specified digital output (slot `S`, bit `D`)is changed when timer `T` (1–32) expires.
	Method Signature:
	`function SetTimer (T : Integer ; S : Integer ; D: Integer) : Syscode;`
	Parameters:
	[in] `T` Timer number
	[in] `S` Digital I/O slot number
	[in] `D` Digital I/O bit number
	SysCode values returned:
	`SysInvalidRequest` The slot or bit number specified is not a valid digital output.
	`SysInvalidTimer` The timer specified by `T` a not valid timer.
	`SysOK` The function completed successfully.
	Example:
	`SetTimer(1,100); -- Set value of Timer1 to 100 (1 second)`
	`SetTimerMode(1,TimerDigoutOn); -- Set timer mode to turn on the digital output`
	`SetTimerDigout(1,0,1); -- Set the digital output to control (slot 0, bit 1)`
	`StartTimer(1); -- Start timer`

Table 5-21. Timer Control Methods

Methods	Description
SetTimerMode 920i 820i 880 1280	Sets the mode value, `M`, of timer `T` (1–32). This function, normally included in a program startup handler, only needs to be called once for each timer unless the timer mode is changed. **Method Signature:** `function SetTimer (T : Integer ; M : TimerMode) : Syscode;` **Parameters:** [in] `T` Timer number [in] `M` Timer mode **TimerMode values sent:** `TimerOneShot` Timer mode is set to one-shot. `TimerContinuous` Timer mode is set to continuous. `TimerDigOutOff` One-shot timer sets a digital output off when the timer expires. `TimerDigOutOn` One-shot timer sets a digital output on when the timer expires. **SysCode values returned:** `SysInvalidTimer` The timer specified by `T` is not a valid timer. `SysInvalidMode` The timer mode specified by `M` is not a valid timer mode. `SysOK` The function completed successfully.
StartTimer 920i 820i 880 1280	Starts timer `T` (1–32). For one-shot timers, this function must be called each time the timer is used. Continuous timers are started only once; they do not require another call to StartTimer unless stopped by a call to the StopTimer function. If a timer has been set with a time-out value of 0, StartTimer will not start the timer but will return SysOk. **Method Signature:** `function StartTimer (T : Integer) : Syscode;` **Parameters:** [in] `T` Timer number **SysCode values returned:** `SysInvalidTimer` The timer specified by `T` is not a valid timer. `SysOK` The function completed successfully.
StopTimer 920i 820i 880 1280	Stops timer `T` (1–32). **Method Signature:** `function StopTimer (T : Integer) : Syscode;` **Parameters:** [in] `T` Timer number **SysCode values returned:** `SysInvalidTimer` The timer specified by `T` is not a valid timer. `SysOK` The function completed successfully.

Table 5-21. Timer Control Methods (Continued)

5.14 Mathematical Operations

Methods	Description
Abs 920i 820i 880 1280	Returns the absolute value of `x`. **Method Signature:** `function Abs (x : Real) : Real;`
ATan 920i 820i 880 1280	Returns a value between $-\pi/2$ and $\pi/2$, representing the arctangent of `x` in radians. **Method Signature:** `function Atan (x : Real) : Real;`
Ceil 920i 820i 880 1280	Returns the smallest integer greater than or equal to `x`. **Method Signature:** `function Ceil (x : Real) : Integer;`

Table 5-22. Mathematical Operation Methods

Methods	Description
Cos 920i 820i 880 1280	Returns the cosine of x. x must be specified in radians. **Method Signature:** `function Cos (x : Real) : Real;`
Exp 920i 820i 880 1280	Returns the value of e^x. **Method Signature:** `function Exp (x : Real) : Real;`
Log 920i 820i 880 1280	Returns the value of $\log_e(x)$. **Method Signature:** `function Log (x : Real) : Real;`
Log10 920i 820i 880 1280	Returns the value of $\log_{10}(x)$. **Method Signature:** `function Log10 (x : Real) : Real;`
Sign 920i 820i 880 1280	Returns the sign of the numeric operand. If x < 0, the function returns a value of –1; otherwise, the value returned is 1. **Method Signature:** `function Sign (x : Real) : Integer;`
Sin 920i 820i 880 1280	Returns the sine of x. x must be specified in radians. **Method Signature:** `function Sin (x : Real) : Real;`
Sqrt 920i 820i 880 1280	Returns the square root of x. **Method Signature:** `function Sqrt (x : Real) : Real;`
Tan 920i 820i 880 1280	Returns the tangent of x. x must be specified in radians. **Method Signature:** `function Tan (x : Real) : Real;`

Table 5-22. Mathematical Operation Methods (Continued)

5.15 Bit-Wise Operation

Methods	Description
BitAnd 920i 820i 880 1280	Returns the bit-wise AND result of X and Y. **Method Signature:** `function BitAnd (X : Integer; Y : Integer) : Integer;`
BitNot 920i 820i 880 1280	Returns the bit-wise NOT result of X. **Method Signature:** `function BitNOT (X : Integer) : Integer;` The function completed successfully.
BitOr 920i 820i 880 1280	Returns the bit-wise OR result of X and Y. **Method Signature:** `function BitOr (X : Integer; Y : Integer) : Integer;`
BitXor 920i 820i 880 1280	Returns the bit-wise exclusive OR (XOR) result of X and Y. **Method Signature:** `function BitXor (X : Integer; Y : Integer) : Integer;`

Table 5-23. Bit-Wise Operation Methods

5.16 String Operations

Methods	Description
Asc 920i 820i 880 1280	Returns the ASCII value of the first character of string S. If S is an empty string, the value returned is 0. **Method Signature:** `function Asc (S : String) : Integer;`
Chr$ 920i 820i 880 1280	Returns a one-character string containing the ASCII character represented by `I`. **Method Signature:** `function Chr$ (I : Integer) : String;` **Parameters:** [in] I The integer value to be converted **Value returned:** A string containing the ASCII character of the integer value.
Hex$ 920i 820i 880 1280	Returns an eight-character hexadecimal string equivalent to `I`. **Method Signature:** `function Hex$ (I : Integer) : String;` **Parameters:** [in] I The integer value to be converted **Value returned:** The string representation of the hexadecimal conversion of the integer value.
LCase$ 920i 820i 880 1280	Returns the string S with all upper-case letters converted to lower case. **Method Signature:** `function LCase$ (S : String) : String;` **Parameters:** [in] `I` The string to be converted to all lower case **Value returned:** The converted string.

Table 5-24. String Operation Methods

Methods	Description
Left$ 920i 820i 880 1280	Returns a string containing the leftmost `I` characters of string `S`. If `I` is greater than the length of `S`, the function returns a copy of `S`. **Method Signature:** `function Left$ (S : String; I : Integer) : String;` **Parameters:** [in] `S` The source string. [in] `I` The number of characters to return in the result. **Value returned:** A string containing the requested number of leftmost characters of the provided string.
Len 920i 820i 880 1280	Returns the length (number of characters) of string `S`. **Method Signature:** `function Len (S : String) : Integer;` **Parameters:** [in] `S` The string. **Value returned:** A string containing the requested number of leftmost characters of the provided string.
Mid$ 920i 820i 880 1280	Returns a number of characters (specified by `length`) from string `s`, beginning with the character specified by `start`. If `start` is greater than the string length, the result is an empty string. If `start + length` is greater than the length of `S`, the returned value contains the characters from `start` through the end of `S`. **Method Signature:** `function Mid$ (S : String; start : Integer; length : Integer) : String;` **Parameters:** [in] `S` The source string. [in] `start` Character position to start from. [in] `length` The number of characters to return in the result. **Value returned:** A string containing the requested portion of the provided string.
Oct$ 920i 820i 880 1280	Returns an 11-character octal string equivalent to `I`. **Method Signature:** `function Oct$ (I : Integer) : String;` **Parameters:** [in] `I` The integer value to be converted. **Value returned:** The string representation of the octal conversion of the integer value.
Right$ 920i 820i 880 1280	Returns a string containing the rightmost `I` characters of string `S`. If `I` is greater than the length of `S`, the function returns a copy of `S`. **Method Signature:** `function Right$ (S : String; I : Integer) : String;` **Parameters:** [in] `S` The source string. [in] `I` The number of characters to return in the result. **Value returned:** A string containing the requested number of rightmost characters of the provided string.
Space$ 920i 820i 880 1280	Returns a string containing `N` spaces. **Method Signature:** `function Space$ (N : Integer) : String;` **Parameters:** [in] `N` The number of spaces to be contained in the string. **Value returned:** The string containing the requested number of spaces.
UCase$ 920i 820i 880 1280	Returns the string `S` with all lower-case letters converted to upper case. **Method Signature:** `function UCase$ (S : String) : String;` **Parameters:** [in] `S` The string to be converted to all upper case. **Value returned:** The converted string.

Table 5-24. String Operation Methods (Continued)

5.17 Data Conversion

Command	Description
IntegerToString 920i 820i 880 1280	Returns a string representation of the integer `I` with a minimum length of `W`. If `W` is less than zero, zero is used as the minimum length. If `W` is greater than 100, 100 is used as the minimum length. **Method Signature:** `function IntegerToString (I : Integer; W : Integer) : String;` **Parameters:** [in] `I` The integer value to be converted. [in] `W` The minimum length of the string.
RealToString 920i 820i 880 1280	Returns a string representation of the real number `R` with a minimum length of `W`, with `P` digits to the right of the decimal point. If `W` is less than zero, zero is used as the minimum length; if `W` is greater than 100, 100 is used as the minimum length. If `P` is less than zero, zero is used as the precision; if `P` is greater than 20, 20 is used. **Method Signature:** `function RealToString (R : Real; W : Integer; P: Integer) : String;` **Parameters:** [in] `R` Real variable to convert to a string. [in] `W` Width of the string (same as integer to string). [in] `P` Precision or number of places to the right of the decimal place to display.
StringToInteger 920i 820i 880 1280	Returns the integer equivalent of the numeric string `S`. If `S` is not a valid string, function returns the value 0. **Method Signature:** `function StringToInteger (S : String) : Integer;` **Parameter:** [in] S String to convert to an integer.
StringToReal 920i 820i 880 1280	Returns the real number equivalent of the numeric string `S`. If `S` is not a valid string, the function returns the value 0.0. **Method Signature:** `function StringToReal (S : String) : Real;` **Parameter:** [in] S String to convert to.
SysCodeToString 920i 820i 880 1280	Returns a string representation of the SysCode Code. ("Code" should be in the same font used for parameters - see the descriptions of other APIs for examples) **Method Signature:** `function SysCodeToString(Code : SysCode): String;` **Parameter:** [in] S String to convert to **Value Returned:** The string. *Example:* *result : Syscode;* *...* *result := SetFileTermination(FileCRLF);* *WriteLn(1, SysCodeToString(result));*

Table 5-25. Data Conversion Commands

5.18 High Precision

Command	Description
DecodeExtFloat 920i 820i 1280	A five-byte IEEE-1594 extended floating point number, expressed as an array or bytes, is converted to a standard 4-byte floating point real. NaN and infinity are processed. If a number is too small to convert to 4-byte precision, zero is returned. If a number is too large to convert to 4-byte precision, infinity is returned. **Method Signature:** `function DecodeExtFloat( weight : ExtFloatArray ) : real;`
EncodeExtFloat 920i 820i 1280	Converts a 4-byte floating point real to a 5-byte IEEE-1394 extended floating point number in the form of an array of five bytes. **Method Signature:** `function EncodeExtFloat( weight : real ) : ExtFloatArray;`

Table 5-26. High Precision Commands

5.19 File I/O

A user program may have only one file open at a time. Once opened, any further file accesses will be to that file.

Methods	Description
USBFileOpen 920i 1280	Read a file from the flash drive. Opening a file as Read positions the internal pointer at the start of the file. Opening a file as Create or Append positions the internal pointer at the end of the file. Any attempt to read a file opened as Create or Append will return SysEndOfFile. **Method Signature:** function (filename : string; mode : FileAccessMode) : Syscode; **Parameters:** `[in]` `filename` The indicator will look in a folder named whatever the indicator's UID is set for (defaulted to 1) for the filename sent as the parameter. Use the entire path (without the drive). [in] mode How the file is to be opened: FileCreate, FileAppend, or FileRead. See FileAccessMode in Section 4.0 on page 27 **SysCode values returned:** SysOk SysNoFileSystemFound SysPortBusy SysFileNotFound SysDirectoryNotFound SysFileExists SysInvalidFileFormat SysBadFilename (over 8 characters) SysEndOfFile *Examples:* *`USBFileOpen(Testing.txt, FileCreate);`* *--Creates a new empty file called Testing.txt.* *`USBFileOpen(Testing.txt,FileAppend);`* *--Adds to a currently stored file called Testing.txt* *`USBFileOpen(test,FileRead);`* *--Reads from a currently stored file*
USBFileClose 920i 1280	Used to close a currently opened file (see USBFileOpen). A file must be closed before device removal or the file contents may be corrupted. **Method Signature:** function (filename : string) **Parameters: None** **SysCode values returned:** SysOk SysNoFileSystemFound SysMediaChanged SysNoFileOpen

Table 5-27. USB Methods

Methods	Description
USBFileDelete 920i 1280	Deletes a file saved to the USB drive. To overwrite an existing file, the user program should first delete the file, then reopen it with Create access. **Method Signature:** function (filename : string) **Parameters:** Filename - The indicator will look in a folder named whatever the indicator's UID is set for (defaulted to 1) for the filename sent as the parameter. **SysCode values returned:** SysOk SysNoFileSystemFound SysPortBusy SysFileNotFound SysDirectoryNotFound SysBadfilename *Example:* `USBFileDelete(Testing.txt);`
USBFileExists 920i 1280	Checks to see if a file exists on the USB drive. **Method Signature:** function (filename : string) **Parameters:** Filename - The indicator will look in a folder named whatever the indicator's UID is set for (defaulted to 1) for the filename sent as the parameter. **SysCode values returned:** SysOk SysNoFileSystemFound SysPortBusy SysInvalidMode SysBadfilename *Example:* `USBFileExists(Testing.txt);`

ReadLn
920i
1280
	Read a string from whatever file is currently open. The string will be placed in a string-type-variable that must be defined.
	Method Signature:
	function (var data : string)
	Parameters:
	Data: This is the string type variable that the data will be placed in to display or print or otherwise be used by the program. It reads one line at a time and the entire line is in this string.
	SysCode values returned:
	SysOk
	SysNoFileOpen
	SysMediaChanged
	SysNoFileSystemFound
	SysEndOfFile
	Example:
	`Result := ReadLn(sTempString); --Reads a line of data from whatever file is open`
	`while Result <> SysEndOfFile   --Loops, looking at the return code until the end`
	`loop`
	`   Result := ReadLn(sTempString);`
	`   WriteLn(3, sTempString);     --Prints each line read out Port 3`
	`end loop;`

Table 5-27. USB Methods (Continued)

Methods	Description
WriteLn **Write** 920i 1280	These APIs both write out a port (and are not new to USB but can be used by the USB). If writing to the USB drive it will append the string to the end of the currently open file. The only difference between the two is the WriteLn sends a carriage return/line feed at the end, and Write does not. **Method Signature:** Function: (port : integer; data : string) **Parameters:** Port - Whichever port on the indicator the data will be sent out of. Port 2 is used for USB. *Example:* `see ReadLn.`

GetUSBStatus
920i
	`Returns the most recent status report for the USB port. This is useful for validating a Write or WriteLn.`
	Example:
	`Result := GetUSBStatus;`

GetUSB Assignment
920i
	Returns the DeviceType currently in use.
	Example:
	`dDevice := GetUSBAssignment;  -- verify the assignment`
	`if dDevice = USBFileSystem then`
	`   WriteLn(3,"USBFlashDrive");`
	`elsif dDevice = USBHostPC then`
	`   WriteLn(OutPort,"USBHostPC");`
	`elsif dDevice = USBPrinter2 then`
	`   WriteLn(OutPort,"USBPrinter2");`
	`elsif dDevice = USBPrinter1 then`
	`   WriteLn(OutPort,"USBPrinter1");`
	`elsif dDevice = USBKeyboard then`
	`   WriteLn(OutPort,"USBKeyboard");`
	`else`
	`   WriteLn(OutPort,"Device Unknown");`
	`end if;`

SetUSB Assignment
920i
	Selects a secondary device for current use, capturing the current device as primary.
	Method Signature:
	Function: (device : USBDeviceType)
	Parameters:
	`device (see Section 4.0).`
	SysCode values returned:
	SysOk
	SysDeviceNotFound
	SysPortBusy
	Example:
	`SetUSBAssignment(USBHostPC);`

ReleaseUSB Assignment 920i	Returns the current USB device to the captured primary device. **SysCode values returned:** SysOk SysDeviceNotFound SysPortBusy *Example:* `ReleaseUSBAssignment;`

Table 5-27. USB Methods (Continued)

Methods	Description

IsUSBDevice Present
920i
	Checks to see if the device passed is there or not.
	Method Signature:
	Function: (device : deviceType)
	Parameters:
	`device (see Section 4.0).`
	SysCode values returned:
	SysOk
	SysDeviceNotFound
	Example:
	`Result := IsUSBDevicePresent(USBFileSystem);`
	`if Result <> SysOk then`
	`   WriteLn(OutPort,"Flash Drive Not Found");`
	`else`
	`   WriteLn(OutPort,"SysOK");`
	`end if;`

SetFileTermin 920i 1280	This determines what is appended at the end of each line. `Termin` - See Section 4.0 for LineTermination type options. **Method Signature:** Function: (termin : LineTermination) *Example:* `SetFileTermin(FileCRLF);`
DBLoad 920i	Opens a file in Read mode using the name of the database and the Unit ID and calls the core to process it as a database file. The file is closed when done. **Method Signature:** Function: (database name) **SysCode values returned:** SysOk SysNoSuchDatabase SysNoFileSystemFound SysFileAlreadyOpen SysFileNotFound SysDirectoryNotFound SysInvalidFileFormat SysPortBusy *Example:* if DBLoad("Product") = Sysok then DisplayStatus("Product Database Loaded into 920i") end if;
DBSave 920i	Opens a file in Create mode using the name of the database and the Unit ID and calls the core to process it as a database file. File is closed when done. For example if the Unit ID in the 920i was 5, it would store a file to E:/5/Product.txt. (If your computer recognized the thumb drive as drive E). **Method Signature:** Function: (database name) **SysCode values returned:** SysOk SysNoSuchDatabase SysNoFileSystemFound SysFileAlreadyOpen SysFileNotFound SysDirectoryNotFound SysFileExists SysPortBusy *Example:* if DBSave("Product") = Sysok then DisplayStatus("Product Database Saved to thumb drive") end if;

Table 5-27. USB Methods (Continued)

Methods	Description
USBWrite 1280	Writes the text specified in the <arg-list> to the current text file. A subsequent USBWrite or USBWriteLn operation will begin where this USBWrite operation ends; a carriage return is not included at the end of the data. **Method Signature:** `procedure USBWrite (<arg-list>);` **Parameters:** [in] arg_list Output text
USBWriteLn 1280	Writes the text specified in the <arg-list> to the current text file, followed by a carriage return and a line feed (CR/LF). A subsequent USBWrite or USBWriteLn opteration begins on the next line. **Method Signature:** `procedure USBWriteLn (<arg-list>);` **Parameters:** [in] arg_list Print text
FileOpen 1280	Opens text file F on device D with access mode M. This text file will be used for all subsequent USBWrite and USBWriteLn operations. **Method Signature:** `function FileOpen (F : String; D : FileDevice; M : FileAccessMode) : SysCode;` **Parameters:** [in] F File name [in] D Device where text file will be created [in] M File access **SysCode values returned:** SysFileOpen There is already a text file open SysRequestFailed Could not open requested file SysOk Function completed successfully
FileExists 1280	Returns status indicating whether file F exists on device D. **Method Signature:** `function FileExists (F : String; D : FileDevice) : SysCode;` **Parameters:** [in] F File name [in] D File device **SysCode values returned:** SysFileNotFound File does not exist SysOk File exists
FileDelete 1280	Deletes file F from device D. **Method Signature:** `function FileDelete (F : String; D : FileDevice) : SysCode;` **Parameters:** [in] F File name [in] D File device **SysCode values returned:** SysFileOpen File cannot be deleted because it is currently open SysFileNotFound File does not exist SysOk File successfully deleted

Table 5-27. USB Methods (Continued)

6.0 Appendix

6.1 Event Handlers

Handler	Description
AlertHandler	Runs when an error is generated from an attached iQube. Use the EventString function to retrieve the error message displayed by the 920i.
BusCommandHandler	Runs when data is received on the fieldbus. SetImage() must be called before BusCommandHandler() will be activated again. A new activation of the handler can occur when new data is present on the bus.
ClearKeyPressed	Runs when the CLR key on the numeric keypad is pressed
ClearKeyReleased	Runs when the CLR key on the numeric keypad is released
Cmd*x*Handler	Runs when an F#*x* serial command is received on a serial port, where *x* is the F# command number, 1–32. The communications port number receiving the command and the text associated with the F#*x* command can be returned from the Cmd*x*Handler using the EventPort and EventString functions (see page 44).
ConnectionChar Received	Returns a string which is the connection name. This will be any of TCPC1, TCPC2, PORT1-PORT32. This handler will be queued up for the following events: • Data received on either of the TCP ports - TCPC1, TCPC2 • Data received on any of the serial ports - PORT1..PORT32 if there is no PortxCharReceived handler installed. • The connection must be configured for Programmability **Note** ***This is not the configured Alias. This is the same name to be used in the WriteOut/ WriteOutLn APIs.***
DiginS*x*B*y*Activate	Runs when the digital input assigned to slot *x*, bit *y* is activated. Valid bit assignments for slot 0 are 1–4; valid bit assignments for slots 1 through 14 are 1–24.
DiginS*x*B*y*Deactivate	Runs when the digital input assigned to slot *x*, bit *y* is deactivated. Valid bit assignments for slot 0 are 1–4; valid bit assignments for slots 1 through 14 are 1–24.
DotKeyPressed	Runs when the decimal point key on the numeric keypad is pressed
DotKeyReleased	Runs when the decimal point key on the numeric keypad is released
EnterKeyPressed	Runs when the ENTER key on the front panel is pressed
EnterKeyReleased	Runs when the ENTER key on the front panel is released
GrossNetKeyPressed	Runs when the GROSS/NET key is pressed
GrossNetKeyReleased	Runs when the GROSS/NET key is released
KeyPressed	Runs when any front panel key is pressed. Use the EventKey function within this handler to determine which key caused the event.
KeyReleased	Runs when any front panel key is released. Use the EventKey function within this handler to determine which key caused the event.
MajorKeyPressed	Runs when any of the five preceding major keys is pressed. Use the EventKey function within this handler to determine which key caused the event.
MajorKeyReleased	Runs when any of the five preceding major keys is released. Use the EventKey function within this handler to determine which key caused the event.
Menukeypressed	Runs when Menu key is pressed. Use the EventKey function within this handler to determine which key caused the event. (880 only)
Menukeyreleased	Runs when Menu key is released. Use the EventKey function within this handler to determine which key caused the event. (880 only)
NavDownKeyPressed	Runs when the DOWN navigation key is pressed
NavDownKeyReleased	Runs when the DOWN navigation key is released
NavKeyPressed	Runs when any of the navigation cluster keys (including ENTER) is pressed. Use the EventKey function within this handler to determine which key caused the event.

Table 6-1. Event Handlers

Handler	Description
NavKeyReleased	Runs when any of the navigation cluster keys (including ENTER) is released. Use the EventKey function within this handler to determine which key caused the event.
NavLeftKeyPressed	Runs when the LEFT navigation key is pressed
NavLeftKeyReleased	Runs when the LEFT navigation key is released
NavRightKeyPressed	Runs when the RIGHT navigation key is pressed
NavRightKeyReleased	Runs when the RIGHT navigation key is released
NavUpKeyPressed	Runs when the UP navigation key is pressed
NavUpKeyReleased	Runs when the UP navigation key is released
NumericKeyPressed	Runs when any key on the numeric keypad (including CLR or decimal point) is pressed. Use the EventKey function within this handler to determine which key caused the event.
NumericKeyReleased	Runs when any key on the numeric keypad (including CLR or decimal point) is released. Use the EventKey function within this handler to determine which key caused the event. Not supported in the 880 or 920i.
N*x*KeyPressed	Runs when a numeric key is pressed, where *x*=the key number 0–9
N*x*KeyReleased	Runs when a numeric key is released, where *x*=the key number 0–9
PortxCharRecieved	Runs when a character is received on port *x*, where *x* is the port number, 1–32. Use the EventChar function within these handlers to return a one-character string representing the character that caused the event.
PrintFmt*x*	Runs when a print format *x* (1–10) that includes the event raised (<EV>) token is printed.
PrintKeyPressed	Runs when the PRINT key is pressed
PrintKeyReleased	Runs when the PRINT key is released
ProgramStartup	Runs when the indicator is powered-up or when exiting setup mode
SoftKeyPressed	Runs when any softkey is pressed. Use the EventKey function within this handler to determine which key caused the event.
SoftKeyReleased	Runs when any softkey is released. Use the EventKey function within this handler to determine which key caused the event.
Soft*x*KeyPressed	Runs when softkey *x* is pressed, where x=the softkey number, 1–5, left to right
Soft*x*KeyReleased	Runs when softkey *x* is released, where x=the softkey number, 1–5, left to right
SP*x*Trip	Runs when setpoint *x* is tripped, where *x* is the setpoint number, 1–maximum number of supported setpoints.
TareKeyPressed	Runs when the TARE key is pressed
TareKeyReleased	Runs when the TARE key is released
Timer*x*Trip	Runs when timer *x* is tripped, where *x* is the timer number, 1–32
UnitsKeyPressed	Runs when the UNITS key is pressed
UnitsKeyReleased	Runs when the UNITS key is released
User*x*KeyPressed	Runs when a user-defined softkey is pressed, where *x* is the user-defined key number, 1–10
User*x*KeyReleased	Runs when a user-defined softkey is released, where *x* is the user-defined key number, 1–10
UserEntry	Runs when the ENTER key or Cancel softkey is pressed in response to a user prompt
WidgetClicked	Handler activated when any of the widgets are touched. Works with EventWidget API which returns the number of the widget that was clicked.
xKeyReleased	This class of event handlers is activated when a key is released. The x is replaced with the name of the key. Key names are the same as for the xKeyPressed handlers. Note ***The xKeyReleased handlers are subject to the same timing considerations as all other user handlers. The events are queued in the order they are detected. Any handler that involves lengthy operations may delay the start of other handlers.***
ZeroKeyPressed	Runs when the ZERO key is pressed
ZeroKeyReleased	Runs when the ZERO key is released

Table 6-1. Event Handlers (Continued)

6.2 Compiler Error Messages

Error Messages	Cause (Statement Type)
Argument is not a handler name	Enable/disable handler
Arguments must have intrinsic type	Write/Writeln
Array bound must be greater than zero	Type declaration
Array bound must be integer constant	Type declaration
Array is too large	Type declaration
Conditional expression must evaluate to a discrete data type	If/while statement
Constant object cannot be stored	Object declaration
Constant object must have initializer	Object declaration
Exit outside all loops	Exit statement
Expected array reference	Subscript reference
Expected object or function reference	Qualifying expression
Expression must be numeric	For statement
Expression type does not match declaration	Initializer
Function name overloads handler name	Function declaration uses name reserved for handler
Handlers may not be called	Procedure/function call
Identifier already declared in this scope	All declarations
Illegal comparison	Boolean expression
Index must be numeric	Subscript reference
Invalid qualifier	Qualifying expression
Loop index must be integer type	For statement
Name is not a subprogram	Procedure/function call
Name is not a valid handler name	Handler declaration
Not a member of qualified type	Qualifying expression
Only a function can return a value	Procedure/handler declaration
Operand must be integer or enumeration type	Function or procedure call
Operand must be integer type	Logical expression
Operand type mismatch	Expression
Parameter is not a valid l-value	Procedure/function call
Parameter type mismatch	Procedure/function call
Parameters cannot be declared constant	Subprogram declaration
Port parameter must be integer type	Write/Writeln
Procedure name overloads handler name	Procedure declaration uses name reserved for handler
Procedure reference expected	Subprogram invocation
Record fields cannot be declared constant	Type declaration
Record fields cannot be declared stored	Type declaration
Reference is not a valid assignment target	Assignment statement
Return is only allowed in a subprogram	Startup body
Return type mismatch	Return statement
Step value must be constant	For statement
Subprogram invocation is missing parameters	Procedure/function call
Syntax error	Any statement
Cannot find system files	Internal error
Compiler error — Context stack error	Internal error
Too many names declared in this context	Any declaration
Operand must be numeric	Numeric operators

Table 6-2. iRite Compiler Error Messages

Error Messages	Cause (Statement Type)
Subprogram reference expected	Procedure/function call
Type mismatch in assignment	Assignment statement
Type reference expected	User-defined type name
Undefined identifier	Identifier not declared
VAR parameter type must match exactly	Procedure/function call
Wrong number of array subscripts	Subscript reference
Wrong number of parameters	Procedure/function call

Table 6-2. iRite Compiler Error Messages

6.3 Database Operations

The *1280*, *820i* and *880* use *Revolution* and the *920i* uses *iRev* to edit, save, and restore databases. This section describes procedures for maintaining databases.

6.3.1 Uploading

To upload a database from the indicator (for viewing, editing, or backup), do the following:

1. Make a serial connection between the PC and the indicator.
2. Start *Revolution/iRev.*
3. Connect to the indicator by clicking on the **Connect** button on the right side of the top toolbar
4. Click the ***Database*** bar on the left side of the *Revolution/iRev* window
5. Click the ***Data Editor*** icon.
6. Select the database to upload, then click the **Upload** button on top right of the toolbar.
7. A status message box will confirm that *Revolution/iRev* is ***Uploading Data***. When complete, the message will change to ***Upload Complete. Please export your data to a delimited file for backup***. Press **OK**.

The contents of the indicator database can now be viewed, edited, or exported.

Note ***Changing the database in Revolution/iRev does not change the database stored in the indicator; the existing indicator database must be cleared and replace it by downloading the edited database (see Section 6.3.5 on page 87).***

6.3.2 Exporting

For display, printing, or backup, save a database opened in *Revolution/iRev* to a text file by using the ***Export*** function.

1. With an open database uploaded to or created in *Revolution/iRev*, click **Export** on the top toolbar.
2. A dialog box is shown to select the separator (delimiter) to be used to separate the database fields.

   Examples:

   Tab-delimiting – `ElliotRobert1234555-8686`

   Semi-colon delimiting – `Elliot;Robert;1234;555-8686`
3. Once delimiter is selected, press **Begin**. A prompt appears to choose where to store the text file, save it in the same folder as other program files.

When complete, a message box confirms ***Export Successful***. The exported file can be used for viewing or printing the database, or for later import to *Revolution* for download to the indicator.

6.3.3 Importing

Import brings a previously exported text file into *Revolution/iRev*. The imported database can then be downloaded to the indicator.

1. Start the *Revolution/iRev* Data Editor and select the table you into which you want to import data.
2. Press **Import** on the top toolbar.
3. A dialog box appears to select the file to import. Double click on the file to import.

4. The ***Data Import Wizard*** box appears that displays the first couple of rows of data in your file. **Notice that the field names are shown as the first row**. They should not be imported into the database since the field names are not part of the data. Click the up arrow next to ***Start import at row:*** prompt to start at row 2 (the actual data).
5. Press ***Next*** and select the separator (delimiter) character used when the file was exported (the default is tab-delimited).
6. Press ***Next*** again, then Press ***Finish*** to import the file. All of the data should now be displayed in *Revolution/iRev*. To downloaded the imported database to the indicator, follow the procedure described in Section 6.3.5.

6.3.4 Clearing

The Clear All button on the top of the toolbar in the *Revolution/iRev* Data Editor clears both the *Revolution/iRev* screen and the entire indicator database. The existing indicator database must be cleared before downloading edited data, but this function must be used with care to avoid losing data.

To clear a database:

1. Upload the database from the indicator (see Section 6.3.1).
2. Edit the database and fields, if necessary.
3. Use the ***Export*** function described in Section 6.3.2 to save a copy of the database.
4. Highlight all of the fields at once and copy them using either Ctrl-C or by choosing ***Edit-Copy*** from the toolbar.
5. Press the Clear All button to clear both the indicator database and the *Revolution/iRev* fields.
6. Upload the blank database from the indicator to ensure data integrity. The lock symbol on the *Revolution/iRev* screen will open, allowing a new database to be downloaded.
7. To replace the cleared database with edited data, move the cursor to the upper left-hand box and paste the copied data into the *Revolution/iRev* database. (Press Ctrl-V or choose ***Edit-Paste*** from the toolbar.)
8. Press the Download button to send fresh, edited data back down to the indicator (see Section 6.3.5).

6.3.5 Downloading

Important *When downloading data to the indicator, it does **not** overwrite data that is there. Downloaded data is added to the database regardless of whether it is the same data. If uploaded data is edited in Revolution/iRev and is to be used to replace the indicator database, a Clear All must be done first, upload the cleared (blank) database, and then download the edited data. (See Section 6.3.4 above.)*

1. Create or edit the data in the rows and columns to be entered in the database.
2. With the indicator connected, press the Download button at the top on the toolbar.
3. A status box shows the download progress (***Downloading Row [number] of [total rows]***). When complete, a ***Download completed successfully*** message is shown. The database is now stored in the indicator.

6.4 Fieldbus User Program Interface

(Not used with the 880 Indicator)

The fieldbus data APIs (see Section 5.7 on page 62), two type definitions (BusImage, BusImageReal), and the EventPort function are used to manage fieldbus data.

The function of BusCommandHandler is similar to other user-written event handlers. When present and enabled with the EnableHandler(BusCommandHandler) call, the BusCommandHandler is activated every time a message is received on a fieldbus. Keeping the BusCommandHandler execution short is important in order to not miss data transfers on the fieldbus.

The normal operation of BusCommandHandler is expected to include the following system calls in the following order:

- EventPort
- GetImage, or GetImageReal
- SetImage, or SetImageReal

with intervening code to perform the required user functions. The SetImage or SetImageReal call should be as close to the end of the BusCommandHandler as possible.

The BusImage type is the data type passed in GetImage and SetImage (or, for real data, GetImageReal and SetImageReal).

```
GetImage(fieldbus_no : integer; var data : BusImage) : SysCode
```

This call returns an array of data as received from the fieldbus. As only the data elements received on the fieldbus are changed in a GetImage call, the array should be initialized prior to the GetImage call. The `fieldbus_no` is the number returned by an EventPort call from within the BusCommandHandler.

```
SetImage(fieldbus_no : integer; var data : BusImage) : SysCode
```

This call writes data to the fieldbus chip for access on the next cycle of the PLC. All data elements of the data array should be properly set before calling SetImage. The `fieldbus_no` is the number returned by an EventPort call from within the BusCommandHandler.

Example BusCommandHandler Code

```
--------------------------------------------------------
-- Handler Name : BusCommandHandler
-- Created By : Rice Lake Weighing Systems
-- Last Modified on : 1/16/2003
--
-- Purpose : Example handler skeleton.
--
-- Side Effects :
--------------------------------------------------------
handler BusCommandHandler;
--Declaration Section
busPort : integer;
data : BusImage;
i : integer;
result : SysCode;
begin
    -- Clear out the data array.
    for i := 1 to 32 loop
        data[i] := 0;
    end loop;

    -- Find out which port (which bus card) started this event.
    busPort := EventPort;

    -- Then read the received data.
    result := GetImage(busPort, data);

-- Test result as desired

-- Data interpretation and manipulation goes here.

    -- Finally, put the changed data back.
    result := SetImage(busPort, data);

-- Test result as desired

end;
```

6.5 Program to Retrieve Hardware Configuration

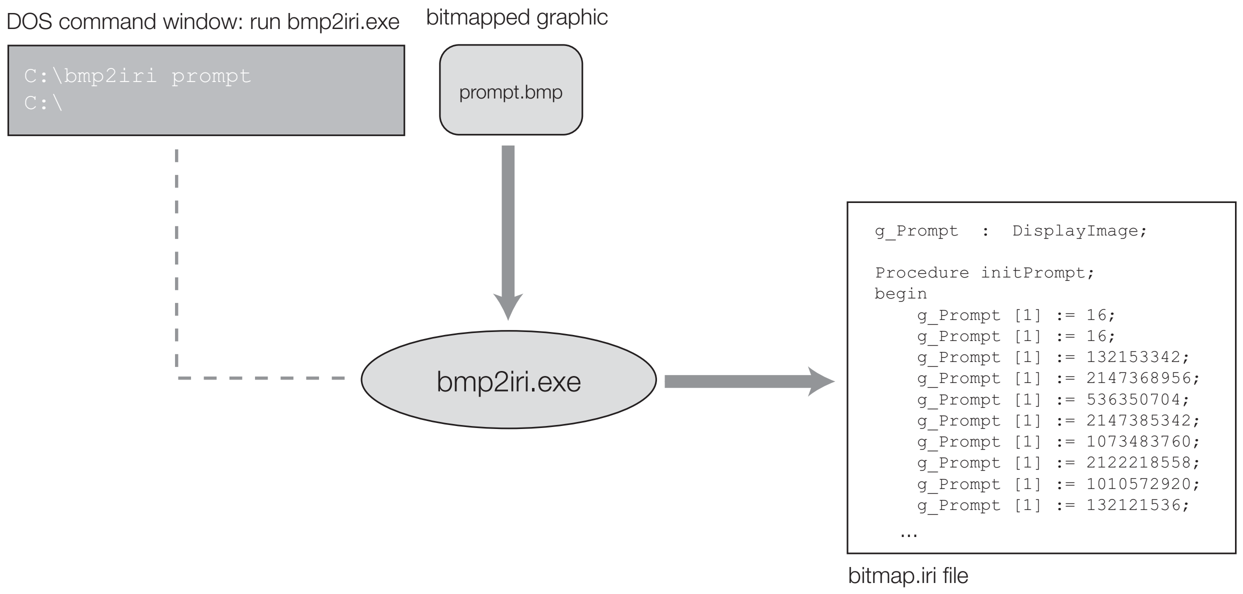
The HARDWARE serial command (see the indicator installation manual) returns a list of coded identifiers to describe which option cards are installed in a system. The following program provides a similar function by deciphering the coded values returned by the HARDWARE command and printing a list of installed option cards.

```
program Hardware;

    my_array : HW_array_type;


handler User1KeyPressed;

  i : integer;
  begin
    Hardware(my_array);
    for i := 1 to 14
    loop
      if my_array[i] = NoCard then
       WriteLn(2,"Slot ",i," No Card");
      elsif my_array[i] = DualAtoD then
       WriteLn(2,"Slot ",i," DualAtoD");
      elsif my_array[i] = SingleAtoD then
       WriteLn(2,"Slot ",i," SinglAtoD");
      elsif my_array[i] = DualSerial then
       WriteLn(2,"Slot ",i," DualSerial");
      elsif my_array[i] = AnalogOut then
       WriteLn(2,"Slot ",i," AnalogOut");
      elsif my_array[i] = DigitalIO then
       WriteLn(2,"Slot ",i," DigitalIO");
      elsif my_array[i] = Pulse then
       WriteLn(2,"Slot ",i," Pulse");
      elsif my_array[i] = Memory then
       WriteLn(2,"Slot ",i," Memory");
      elsif my_array[i] = DeviceNet then
       WriteLn(2,"Slot ",i," DeviceNet");
      elsif my_array[i] = Profibus then
       WriteLn(2,"Slot ",i," Profibus");
      elsif my_array[i] = Ethernet then
       WriteLn(2,"Slot ",i," Ethernet");
      elsif my_array[i] = ABRIO then
       WriteLn(2,"Slot ",i," ABRIO");
      elsif my_array[i] = BCD then
       WriteLn(2,"Slot ",i," BCD");
      elsif my_array[i] = DSP2000 then
       WriteLn(2,"Slot ",i," DSP2000");
      elsif my_array[i] = AnalogInput then
       WriteLn(2,"Slot ",i," AnalogInput");
      elsif my_array[i] = ControlNet then
       WriteLn(2,"Slot ",i," ControlNet");
      elsif my_array[i] = DualAnalogOut then
       WriteLn(2,"Slot ",i," DualAnalogOut");
      end if;
    end loop;
    WriteLn(2,"");
  end;
end Hardware;
```

6.6 920i User Graphics

iRite user programs can be used to display graphics. The entire *920i* display is writable; graphics can be of any size, up to the full size of the *920i* display, and up to 100 graphic images can be displayed. The actual number of graphics that can be loaded depends on the size of the graphics and of the user program, both of which reside in the user program space.

Graphics used in *iRite* programs can be from any source but must be saved as monochrome bitmap (.bmp) files with write access (file cannot be read-only). To enable the file for use in an *iRite* program, it is converted to a user program #include (.iri) file using the bmp2iri.exe program (see Figure 6-1).



```
C:\bmp2iri prompt
C:\
```

```
g_Prompt  :  DisplayImage;

Procedure initPrompt;
begin
    g_Prompt [1] := 16;
    g_Prompt [1] := 16;
    g_Prompt [1] := 132153342;
    g_Prompt [1] := 2147368956;
    g_Prompt [1] := 536350704;
    g_Prompt [1] := 2147385342;
    g_Prompt [1] := 1073483760;
    g_Prompt [1] := 2122218558;
    g_Prompt [1] := 1010572920;
    g_Prompt [1] := 132121536;
  ...
```

Figure 6-1. Example of Converting Bitmapped Graphic (prompt.bmp) to an .iri File

Figure 6-1 shows the conversion process for a graphic file, prompt.bmp, to a user program #include, bitmap.iri. The conversion is done by running the bmp2iri.exe program in a DOS command window: note that the bmp2iri program assumes the .bmp extension for the input graphic file (prompt.bmp). If additional files are converted using bmp2iri.exe, the output of the program is appended to the bitmap.iri file.

To display the graphic, the bitmap.iri file must be incorporated into the user program by doing the following:

- In the *iRite* source (.src) file, immediately following the program declaration, add: `#include bitmap.iri`
- In the startup handler, call the array initialization routine for each graphic.
- To display or erase a graphic, or to clear all graphics, call the DrawGraphic API with the appropriate parameters (see page 67).

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