

White Paper: Removable Storage Media Add Flexibility to Modern Day PLC's

The question "Why can't my PLC interface easily to off-the-shelf devices?" is being answered by a new wave of PLCs with standard interfaces to common peripheral devices. Without sacrificing the deterministic operation, reliability, and ease of use of the traditional PLC, modern day PLCs are now incorporating more and more PC features than ever before. One such feature becoming commonplace in this new generation of PLCs is an interface to removable storage media. Interfaces to memory devices such as USB memory devices and CompactFlash® are providing flexibility never before realized in PLC architectures.

Removable storage media bring flexibility to data collection and recipe storage applications in PLCs. For data collection, the PLC no longer needs to communicate directly to an external device, but can operate stand-alone, storing data to the removable memory device only to be retrieved at a later date. Data can still be collected by an external device, or can be retrieved by an onsite service technician. The technician can walk up to the PLC, remove one memory card replacing it with another, and walk away. Because these memory devices are capable of holding gigabytes of data, weeks, months, or even years of collected data can be stored to a single device. Similarly, an operator can change the recipe used in a process, or change the profile used in a motion application by swapping one storage device for another.

Data collection and recipe storage have always been challenging for PLCs because of their inefficiencies in sharing data with other devices. PLCs have long been used for data collection, and while the PLC may be good at collecting data, sharing that data with external devices is typically a cumbersome task. The PLC, being register-based, could only share information as blocks of raw unformatted data. Accurate management of these blocks of registers is critical, as the smallest addition or omission by the PLC significantly changes the meaning of the data to the external device. Similarly, downloading recipes that define process parameters to a PLC requires the same register management. The block of registers in the PLC that is receiving the recipe data needs to be identical to the incoming data from the host device. The slightest variance gives a whole new meaning to the process being controlled.

A USB or CompactFlash® memory device formatted as file memory offers the benefit of being able to hold data stored not as raw register data, as in the PLC, but as user-specified formatted strings of data. The formatting and syntax of the data is programmable and entirely up to the user. Data can be encrypted, or stored in commonly used formats, such as CSV (Comma Separated Value).

The CSV format is a commonly used way of transferring data between programs. It is typically used for spreadsheet and database applications because it is well-suited to data arranged in tables, that is, made up of rows and columns. Files of the CSV format are often referred to as comma delimited. A delimiter is one or more characters used to separate data – in this case, a comma.

As an example, last week's daily weather recorded in a CSV formatted file may look like this:

```
Monday,75,Sunny  
Tuesday,72,Partly Sunny  
Wednesday,76,Sunny  
Thursday,68,Rain  
Friday,69,Cloudy
```

Most PLC programming software packages contain instruction sets for working with STRING variables, making it easy to manipulate data and/or text into files of various formats. PLCs with real-time clocks provide commands for embedding date and time values in data strings.

The following example shows how to create the first record of the daily weather data file:

Example using Structured Text programming language in CoDeSys development software

```

0001 Record := 'Monday';      (* Begin the data string with the day of the week *)
0002
0003 Record := CONCAT(Record, ','); (* Append a comma to separate the data *)
0004
0005 Record := CONCAT(Record, WORD_TO_STRING(Temperature)); (* Append the string value of the temperature *)
0006
0007 Record := CONCAT(Record, ','); (* Append a comma to separate the data *)
0008
0009 Record := CONCAT(Record, 'Sunny'); (* Append the word 'Sunny' to describe the day's conditions *)
0010
0011 Record := CONCAT(Record, '$N'); (* Append a new-line character to indicate the end of the record *)
0012

```

Commands familiar to VB and C programmers are used to open files on memory devices, and read, write, and append data. Multiple files can usually be opened simultaneously, and commands are often supported for creating file folders on memory devices to better organize data.

Example using Structured Text programming language in CoDeSys development software

```

0014 (*Open File, Append Record to existing file contents, and Close File *)
0015 FileID:=SysFileOpen(filename,'a');
0016
0017 IF FileID <> 0 THEN
0018     SysFileWrite(FileID, ADR(Record), LEN(Record));
0019     SysFileClose(FileID);
0020 END_IF
0021

```

As you can see, the Structured Text programming language of the IEC-61131 standard is well suited for manipulating data strings. However, other supported languages such as Ladder Diagram or Function Block Diagram can also be used to perform the tasks shown above.

Summary

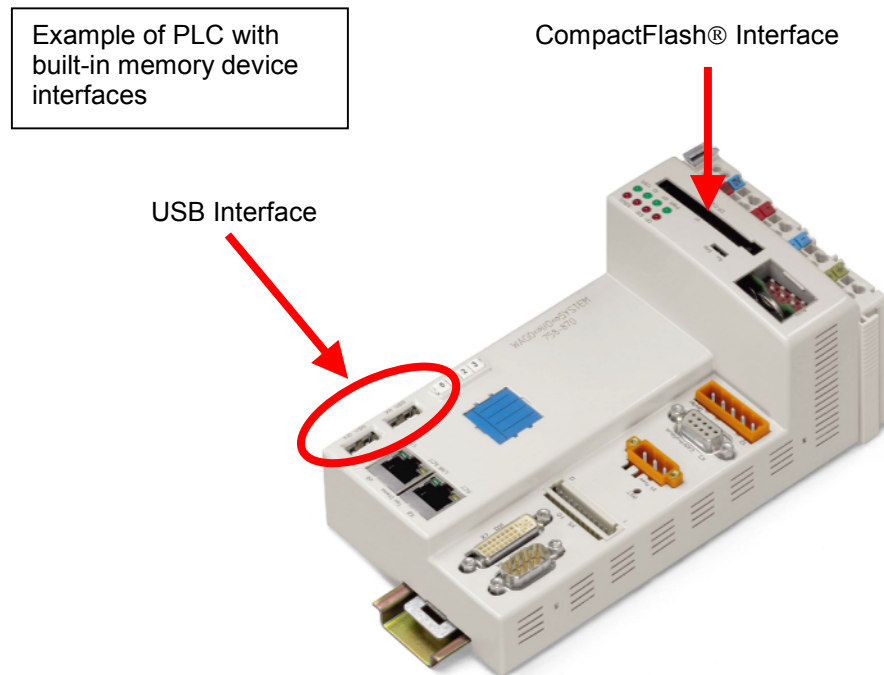
The PLC is not dead, but has taken on new life incorporating several of the features that have allowed PCs to creep down to the plant floor. Interfaces to memory devices such as USB memory devices and CompactFlash® give the PLC enhanced data sharing capabilities, including gigabyte volumes of data storage, portability, and control over data syntax. Instruction sets in today's IEC-61131 programming development systems support data formatting, read and write file operations, and other data organization tools for conveniently sharing data with analysis tools such as spreadsheet and database applications. Without sacrificing the deterministic operation, reliability, and ease of use of the traditional PLC, removable storage media are adding new flexibility to modern day PLCs.

What is CompactFlash®?

CompactFlash® is a very small removable mass storage device. First introduced in 1994 by SanDisk Corporation, CF™ cards weigh a half ounce and are the size of a matchbook. CompactFlash cards are designed with flash technology, a non-volatile storage solution that does not require a battery to retain data indefinitely. CompactFlash storage products are solid state, meaning they contain no moving parts, and provide users with much greater protection of their data than conventional magnetic disk drives. They are five to ten times more rugged and reliable than disk drives, and consume only five percent of the power required by small disk drives. CompactFlash® memory devices can hold several gigabytes of data.

What is USB?

Universal Serial Bus, or USB, is a standard designed to eliminate the guesswork in connecting peripherals devices. USB is a connectivity specification developed by the USB Implementers Forum and was originally aimed at peripherals connecting outside the computer in order to eliminate the hassle of opening the computer case for installing cards needed for certain devices. USB interfaces have since found their way into PLC devices, providing this same hassle-free interconnection to peripheral devices. USB provides for ease of use, expandability, and speed for the end user.



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