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Plant Data Interface for the Food & Beverage Industry

Interface description based on Weihenstephan Standards

https://support.industry.siemens.com/cs/ww/en/view/86302104

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Table of Contents

1 Overview of a plant wide automation concept

1.1 Overview of Plant Wide Concepts for food and beverage industry

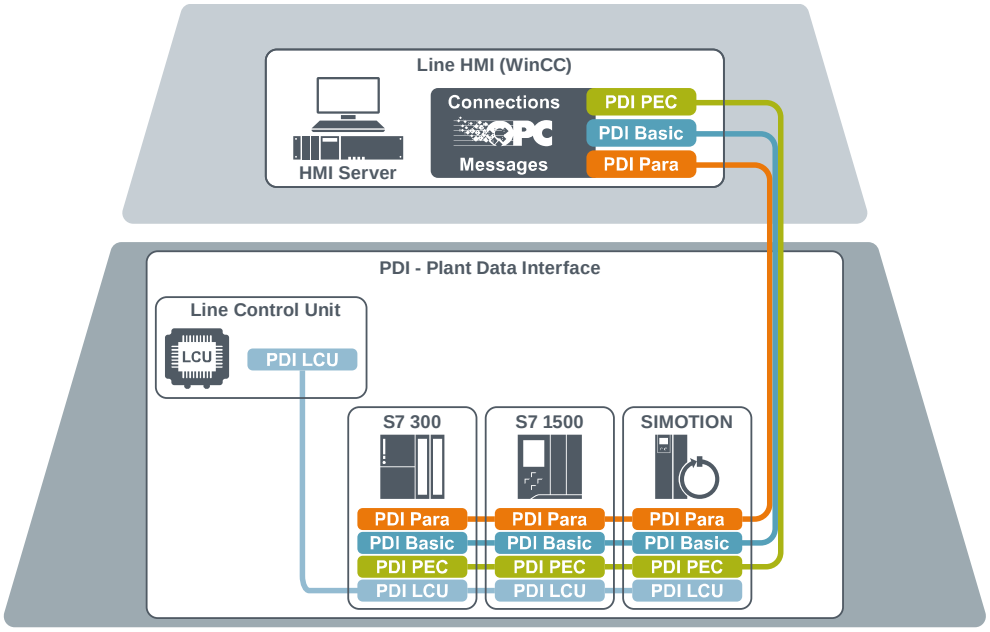
In the Food & Beverage Industry is substantial room for improvement, to increase the efficiency and effectiveness of existing and new production lines.

An essential component to increased efficiency is the integration of production lines and machines, from inbound raw material, through production, packaging and outbound logistics. This integration allows for the recording of essential production parameters, such as quantity produced, machine up-time, etc., which can then be analyzed on upper-level systems, in order to identify measures for improvement.

Today, this task comes with significant effort, as the data is collected from the machines and components of disparate manufacturers, who all provide various levels of data, through a number of different forms. The plant wide automation concept for line integration from Siemens helps by offering standard data interfaces which help give direction to end customers, machine builders and integrators looking to integrated lines. These interfaces provide a coherent collection of data that can be provided to upper level line monitoring, Line HMI and enterprise level systems. The definition of one such interface, for the Weihenstephan standard, is described herein.

1.2 Layout overview for plant wide data interface

The following picture shows the automation information flow related to the Plant Data Interface (PDI) between PSS (Plant Supervisory System) and a OEMs (Original Equipment Manufacturer) machine PLC (Programmable Logic Controller).



The data interface, named PDI Basic, provides the necessary information for Line Visualization and Line Monitoring (LM).

The PDI Basic is available in 2 different versions. One version is available based on the Weihenstephan Standards which is described here and another version for OMAC (Organization for Machine Automation and Control) is described in additional interface documentation.

1.3 Definitions

1.3.1 Default values

All values and counters that are not used or cannot be provided due to an out-of-range or undefined condition have to be set to “–1” or in case of the type STRING to “”. Counters are always “0” or positive.

1.3.2 Data types

Type Used in this document	Description	OMAC	Weihenstephan	S7-Type		SIMOTION	HMI-Type		OPC SIMATIC NET	LM/MES/MOM
				S7-3xx/4xx	S7-1x00		WinCC DM	TIA Portal	S7-3xx/4xx	S7-1x00
DINT	Integer with 32bit	Int(32)	Signed32	DINT	Dint	DINT	Signed 32-bit value	Dint	Int32	LONG
UDINT	Integer with 32bit (positive values only)	n.a.	Unsigned32	DWORD	UDint	UDINT	Unsigned 32-bit value	UDint	UInt32	ULONG
REAL	32bit floating number	REAL	REAL	REAL	Real	REAL	Floating-point 32-bit	Real	Float	REAL
BIT[x]	32bit variable were each bit is interpreted as on unique value 0 or 1	Bool struct	n.a. workaround: use only first bit in Hex32	DWORD each single bit can be addressed	DWORD each single bit can be addressed	DWORD each single bit can be addressed	Binary tag	Bool	UInt32	BOOL array dimension = 32
DWORD	32 bit double word	n.a.	Hex32	DWORD	DWord	DWORD	Unsigned 32-bit value	DWord	UInt32	ULONG
BOOL	Variable 0 or not 0	Bool	n.a.	BOOL	Bool	BOOL	Binary tag	Bool	Boolean	BOOL
STRING	String limited to the number of characters in [num. of characters] ASCII only	String	n.a.	STRING[x]	String[x]	STRING[x]	Text tag 8-bit	String[x]	String	STRING dimension = X
STRING16	16 bit simple Unicode	n.a.	String16	n.a.	n.a	n.a.	Text tag 16-bit	n.a	n.a.	STRING dimension = X

1.4 PDI Overview

1.4.1 PDI Basic

The basic interface provides basic information regarding the machine, e.g. mode and state, machine speed and counters. The flow of information through the interface is from machine/production level (OEM) upwards to the LCU and/or PSS respectively. There is no data transfer from upper level LCUs/PSSs downwards to the machine/production level (OEM). This information is used for:

- Operator information about the machine state for line overviews (HMI), on a line server or an HMI client in a control room.
- Line monitoring for basic OEE / KPI (Overall Equipment Effectiveness / Key Performance Indicators) information.

All data exchanged with the PDI Basic are tag based and can be polled by the upper level at any time. The data itself can be written to the interface e.g. as data block in any PLC cycle. All data should however be written simultaneously to the interface to ensure consistency of data.

1.4.2 PDI LCU

The LCU interface provides additional data for line control functionality, e.g. start/stop and set line speed. Machine state information is communicated upwards from machine/production level (OEM) up to the LCU and/or PSS. Control and command data such as machine speed and start/stop are transmitted downwards from upper level LCUs/PSSs to the machine/production level (OEM).

The data are used…

- to provide operator information about machine speed and entry/exit buffer of single machines on line overview (HMI) screens, on line servers or at HMI clients in a control room
- by the Line Control Unit to control the line, in terms of speed, buffer fill-levels and start/stop of machines

All data exchanged with the PDI LCU between line HMI (PSS) and the OEM PLC are tag based and can be polled by upper level systems at any time. Transfer of data between the Line Control Unit and OEMPLC should be performed block-wise to ensure data consistency.

Implementation of the PDI LCU is only required for systems implementing the Line Control Unit. The LCU is an additional package for a plant wide automation that requires additional hardware and software components.

1.4.3 PDI PEC

The PEC provides additional data for energy monitoring and on top level to support implementation of a corporate energy data management system with following objectives.

- Compliance and support of national and international sustainability programs and standards, like ISO50001
- Continuous improvement of energy and water conservation
- Reduce costs for procurement of energy and water
- Increase employee awareness for energy efficiency

All data exchanged with the PDI-PEC between line HMI (PSS) and the OEM PLC are tag based and can be polled by upper level systems at any time. An implementation of the PDI PEC is optional.

1.4.4 PDI Para

The PDI-Para interface provides additional data for machine specific parameters.

The information can be delivered Integer, Real or String values. The delivered information’s contain typically unit specific, process, order or reporting information’s. The implementation of the PDI Para is optional.

2 Interface description based on Weihenstephan Standards

2.1 PDI Basic

The basic interface provides basic information regarding machine state and parameters. The information is communicated upwards from machine/production level to the PSS level. There is no data transfer from upper level PSS systems downwards to the machine/production level.

This information is used for:

- Operator information about machine state on line overview (HMI) screens, on line servers or on HMI clients in a control room. This includes:
  - machine state and mode information
  - material state information related to the machine
  - alarm information
- Line monitoring of basic OEE / KPI information
  - production results (downtime information, OEE, global efficiency)
  - raised alarm hit list
  - MTTR (Mean time to repair) MTBF (Mean time between failures)
  - KPI trends

All data exchanged via PDI Basicare tag based and can be polled by the upper level at any time. The data itself can be written to the interface e.g. as a data block in any PLC cycle. However all data should be written simultaneously to the interface.

NOTE If using TCP/IP communication (e.g. Weihenstephan Protocol) there shall be no access to the data while the communication is active.

2.1.1 Interface description overview

The interface based on Weihenstephan Standard V08.

Parameter Number	Parameter Name	Type	WS	Man-datory	Description
00030	SIE_Ver_BASIC	String16[10]	☑	☑	PDI version info. “PDI V2.0.0” fix for this implementation
00031	SIE_Ver_Proj_BASIC	String16[10]	☑	☐	Project specific version
00200	WS_Cur_Prog	DWord	☑	☑	Program indicates the current program code = Unit mode
00300	WS_Cur_State	DWord	☑	☑	Operating state related to the machines state model
00402	WS_Set_Mach_Spd	REAL	☑	☑	Set machine speed in primary units/minute
00401	WS_Cur_Mach_Spd	REAL	☑	☑	Current machine speed in primary units/minute
59900	SIE_Mach_Cum_Time	DINT	☐	☐	Machine Cumulative Time powered up - in hours
59901	SIE_Cons_Electricity	DINT	☐	☑	Consumed electrical energy in kWh
10001	SIE_Not_Of_Fail_Group	DINT	☐	☑	Message group as according to OMAC simplify Reason Code definition
10000	WS_Not_Of_Fail_Code	DWord	☑	☐	Notice of failure code (OEM specific)
00701	WS_Prod_Ratio	DWord	☑	☐	Package Ratio in primary pieces
05000	SIE_Prod_Ratio_Typ	DINT	☐	☐	Machine type: 1=depacker, 0=packer: Packer will be default
00190	SIE_Light_Stack	DWord	☐	☐	Represents the machine light stack with different color levels
59902	SIE_Tot_Packages	DWord	☐	☑	Resettable counter of total packages processed by the production machine
50220	WS_Tot_Packages	DWord	☑	☑	Accumulated counter of total packages processed by the production machine
59903	SIE_Bad_Packages	DWord	☐	☑	Resettable counter of bad packages rejected by the production machine
50240	WS_Bad_Packages	DWord	☑	☑	Accumulated counter of bad packages rejected by the production machine
00403	WS_Mach_Design_Spd	REAL	☑	☑	Machine design speed in primary units/minute in the installed environment based on currently processed product

2.1.2 Detailed interface description

SIE_Ver_BASIC

Par.Nr.	Name	Type	Comment
00030	SIE_Ver_BASIC	String16[10]	Version of the used plant data interface

This data point provides a vendor specific version description of the WS interface implementation. “PDI_V2.0.0” is fixed for this implementation. The provided DB are already predefined with this name.

SIE_Ver_Proj_BASIC

Par.Nr.	Name	Type	Comment
00031	SIE_Ver_Proj_BASIC	String16[10]	Project specific version description

This data point provides a project specific version description of the WS interface implementation. Regarding the content there are no specifications determined.

WS_Cur_Prog

Par.Nr.	Name	Type	Comment
00200	WS_Cur_Prog	DWORD	Current program of the machine

The value shows the current program of the machine. The following values are defined according to the Weihenstephan Mode & State model:

Table 2-1

Bit No.	Value		Program	Description
	Binary	integer		
-	00000000	0	Undefined	Undefined mode (No program or mode selected)
0	00000001	1	Production	Machine is in the function production and is able to produce
1	00000010	2	Start up	Machine starts up to get in production mode
2	00000100	4	Run Down	Machine shuts down from production mode
3	00001000	8	Clean	Machine runs cleaning process
4	00010000	16	Changeover	Machined changes from one product to another
5	00100000	32	Maintenance	Machine operates a maintenance program
6	01000000	64	Break	Machine is in pause mode

WS_Cur_State

Par.Nr.	Name	Type	Comment
00300	WS_Cur_State	DWORD	Current machine state

The value indicates the machine state related to the WS machine state model.

Bit Nr.	Value		Operating State
	Binary	Integer	
0	00000000 00000000 00000001	1	Stopped
1	00000000 00000000 00000010	2	Starting
2	00000000 00000000 00000100	4	Prepared
3	00000000 00000000 00001000	8	Lack
4	00000000 00000000 00010000	16	Tailback
5	00000000 00000000 00100000	32	Lack Branch Line
6	00000000 00000000 01000000	64	Tailback Branch Line
7	00000000 00000000 10000000	128	Operating
8	00000000 00000001 00000000	256	Stopping
9	00000000 00000010 00000000	512	Aborting
10	00000000 00000100 00000000	1024	Equipment Failure
11	00000000 00001000 00000000	2048	External Failure
12	00000000 00010000 00000000	4096	Emergency Stop
13	00000000 00100000 00000000	8192	Holding
14	00000000 01000000 00000000	16384	Held
15	00000000 10000000 00000000	32768	Idle
16	00000001 00000000 00000000	65536	Unholding
17	00000010 00000000 00000000	131072	Suspending
18	00000100 00000000 00000000	262144	Unsuspending
19	00001000 00000000 00000000	524288	Resetting
20	00010000 00000000 00000000	1048576	Clearing

For more details see chapter 3.2 State description.

WS_Set_Mach_Spd

Par.Nr.	Name	Type	Comment
00402	WS_Set_Mach_Spd	REAL	Set point of the machine speed in primary pieces/minute

This tag represents the set point of the machine speed in primary pieces/minute. It is less than the value of WS_Mach_Design_Spd.

WS_Cur_Mach_Spd

Par.Nr.	Name	Type	Comment
00401	WS_Cur_Mach_Spd	REAL	Actual machine speed in primary pieces/minute

This tag represents the actual machine speed in primary pieces/minute.

The following example is for a packaging line running at balanced line speed of 1200 bottles/minute. The specified UoM (Unit of Measurement) is chosen to correspond with that of the current count of the filler or labeler.

Machine	Actual Pack Counts	CurMachSpeed in UoM
Bulk Depalletizer	50 (24 pack equiv.)	1.200 bottles/min
Filler	1.200	1.200 bottles/min
Labeler	1.200	1.200 bottles/min
Packer	100 (12 packs)	1.200 bottles/min

The value is calculated cyclically at the machine level.

SIE_Mach_Cum_Time

Par.Nr.	Name	Type	Comment
59900	SIE_Mach_Cum_Time	DINT	Accumulated machine powered up time

This parameter describes the accumulated machine powered up time in hours. The value starts counting as soon as the machine is switched on. There is an overflow to “0” at “2147483647”. This is a non-resettable counter and has to be retained during PLC start/stop and PLC power off.

SIE_Cons_Electricity

Par.Nr.	Name	Type	Comment
59901	SIE_Cons_Electricity	DINT	Current consumed electrical energy

This Parameter describes the current consumed electrical energy in kWh without decimal places.

SIE_Not_Of_Fail_Group

Par.Nr.	Name	Type	Comment
10001	SIE_Not_Of_Fail_Group	DINT	Alarm reason group ID

Alarms are reported via “SIE_Not_Of_Fail_Group”. This ID is related to the Appendix A1 Alarm codes (ANSI/ISA-TR88.00.02-2008). At a minimum, the simplified reason group fault code is to be provided. Should other alarm codes be available, they should be placed within the appropriate range (i.e. Safety Related faults identified with a value from 1-31).

Value	Detailed reason group	Simplified reason group fault code
0		Undefined
32	Safety related	Machine internal reason
64	Operator action	
256	Product related	
512	Equipment fault	
999	All other internal	
2499	Machine ext. Upstream process reason	Main product flow
3499	Machine ext. Downstream process reason	
4499	Out of service (planned and unplanned)	
4999	Branch- or sub-utility equipment	Other external reasons

Most important to the alarm ID are the three main categories

- Machine internal error (value 1 to 1999)
- Machine upstream reason (value 2000 to 2999)
- Machine downstream reason (value 3000 to 3999)

These categories, among other values, are needed for basic RCA (Root Cause Analysis). For line OEE/KPI calculation at least the simplified reason group fault codes are required.

The value is set as soon as the machine detects an error condition. The value is reset as soon the alarm is acknowledged.

After the “SIE_Not_Of_Fail_Group” is acknowledged a new alarm can be set.

NOTE There is a template prepared in the HMI part where the message creation is described:

https://support.industry.siemens.com/cs/ww/en/view/100744248

WS_Not_Of_Fail_Code

Par.Nr.	Name	Type	Comment
10000	WS_Not_Of_Fail_Code	DWORD	Initial machine error

This parameter represents the initial machine error, when the machine exits the state “Operating”, regardless of cause.
The error number has to be reset to “0” (= no error) as soon as the machine goes back to the “Operating” state. In the case that the initial error is not immediately known when the machine exits the “Operating” state, the value “0” will remain and has to be updated, as soon as the initial error is detected.
The error codes are machine/OEM specific. The OEM should provide a list of possible error numbers and their description, in accordance with the Weihenstephan Standard along with the device description file. The file has to contain descriptions in English. If available, the list should contain additional languages.

This parameter is mainly used for operator information on line HMIs and for basic RCA (Root Cause Analysis).

WS_Prod_Ratio

Par.Nr.	Name	Type	Comment
00701	WS_Prod_Ratio	DWORD	Production ratio (sec.pieces/prim.pieces)

The tag WS_Prod_Ratio gives the ratio between exit items (secondary pieces) for the machine and primary pieces of the line.

The value contains the number of primary packages included in the current produced secondary packages. To give an example:

- Packer packs six packs from single bottles → Value = 6
- Depacker empties one crate (20 bottles) into single bottles → Value = 20
- Palletizer empties one pallet (32 crates) into single bottles → Value = 640

Together with “Status.Parameter3.Value” it will be defined if the machine is a packer or an unpacker.

SIE_Prod_Ratio_Typ

Par.Nr.	Name	Type	Comment
00401	SIE_Prod_Ratio_Typ	DINT	Machine Is a packer or a unpacker

This tag indicates if the machine packs or unpacks pieces.
1=depacker, 0=packer. Packer will be set as default.

SIE_Light_Stack

Par.Nr.	Name	Type	Comment
00190	SIE_Light_Stack	DWORD	Machine signal light stack

The machine light stack provides easy indication of the machine state for operators, based on EN / IEC 60204-1.

Color	Meaning	Description and operator task	Light	Signal
Red	Emergency	Hazardous condition. Immediate action to deal with hazardous condition (e.g. switch off Energy supply).	Static	Bit[0]
			Flashing	Bit[1]
Yellow	Abnormal	Abnormal condition impending critical conditions. Monitoring and/or intervention (e.g. by reestablishing intended function).	Static	Bit[2]
			Flashing	Bit[3]
Blue	Mandatory	Indication of a condition that requires an operator action.	Static	Bit[4]
			Flashing	Bit[5]
Green	Normal	Normal condition	Static	Bit[6]
			Flashing	Bit[7]
White	Neutral	Other condition; may be used whenever doubts exist about the implementation of RED;YELLOW,BLUE or GREEN	Static	Bit[8]
			Flashing	Bit[9]

The light stack is mainly used by the operator to identify required operator intervention at the machine.

The colors red and green are mandatory, all others are optional. Machines which require more colors for additional information should be equipped with an extended light stack.

NOTE The flashing lights are used for differentiation or highlighting of the signal:

- to thrill attention
- to request immediate action
- to show discrepancy between command and current state
- to show change of process (e.g transition)

WS_Tot_Packages / SIE_Tot_Packages

Par.Nr.	Name	Type	Comment
50220	WS_Tot_Packages	DWORD	Total number of processed products
59902	SIE_Tot_Packages	DWORD	

These parameters represent the total number of processed products/items by the production machine without decimal places. The unit of measurement is dependent on the product.

Both values represent the sum of rejected and good items produced by the machine.

The parameter “WS_Tot_Packages” is the accumulative sum of all rejected and good items produced by the machine. This is a **non-resettable** counter.

“SIE_Tot_Packages” can be reset manually on the machine level e.g. on shift change, product change, order change, etc. This has to be defined per end customer specification.

Both values must be calculated within the same PLC cycle.

There is an overflow of both values at 2147483647 before starting again with 0. The counters “SIE_Tot_Packages” and “WS_Tot_Packages” count continuously regardless of machine mode (see “WS_Cur_Mode”).

The values of both parameters must be retained during PLC start/stop and PLC power off.

Total and defective counters (see below) require the same units for both values (WS… and SIE…). Not allowed is to count in different units e.g. “WS_Tot_Packages” in six-packs and “WS_Bad_Packages” in single bottles.

WS_Bad_Packages / SIE_Bad_Packages

Par.Nr.	Name	Type	Comment
50240	WS_Bad_Packages	DWORD	Total number of rejected items
59903	SIE_Bad_Packages	DWORD	

These parameters represent the number of rejected items processed by the production machine without decimal places. The unit of measurement is depending on the produced product.

The “WS_Bad_Packages”-parameter is the accumulative sum of all rejected items from the machine. This is a non-resettable counter.

“SIE_Bad_Packages” can be reset manually on the machine level e.g. on shift change, product change, order change, etc. This is to be defined per end customer specification.

There is an overflow of both values at 2147483647 before starting again with 0. Both counters count continuously regardless of machine mode (see “WS_Cur_Mode”).

The counter values must be retained during PLC start/stop and PLC power off.

Total and defective counters require the same units for both values (WS… and SIE…). Not allowed is to count in different units e.g. “WS_Tot_Packages” in six-packs and “WS_Bad_Packages” in single bottles.

WS_Mach_Design_Spd

Par.Nr.	Name	Type	Comment
00403	WS_Mach_Design_Spd	REAL	Maximum machine speed

The value represents the maximum design speed of the machine in primary packages per minute for the current product setup.

The machine design speed provided by the machine builder, indicates the speed of the machine, for the given configuration and product selection. In the event, that the maximum machine speed, be downgraded due to the line constellation, any necessary adjustments for OEE or other KPIs, should be made within the line level and not on a machine level.

2.2 PDI LCU

The LCU interface contains additional data for line control functionality, e.g. start/stop and set line speed. Machine state information is communicated upwards from machine/production level (OEM) up to the LCU and/or PSS. Control and command data such as machine speed and start/stop commands are transmitted downwards from upper level LCUs/PSSs to the machine/production level (OEM). The data is used

- To provide operator information about machine speed and entry/exit buffer of single machines on line overview (HMI) screens, on line servers or at HMI clients in a control room
- By the Line Control Unit to control the line, in terms of speed, buffer fill-levels and start/stop of machines

All data exchanged with the PDI LCU between line HMI (PSS) and the OEM PLC are tag based and can be polled by upper level systems at any time. Transfer of data between the Line Control Unit and OEM PLC should be performed block-wise to ensure data consistency.

Implementation of the PDI LCU is only required for systems implementing the Line Control Unit. The LCU is an additional package for plant wide automation that requires additional hardware and software components.

2.2.1 Interface description overview

This interface based on Weihenstephan Standards V08.

Par. Nr.	Parameter name (interface description)	Type (SIMATIC)	WS	Mandatory	Descrition
00250	SIE_Set_Cur_Prog	DWord	☐	☑	Unit prog (Unit mode) target required by line system for this machine
00251	SIE_Prog_Change_Req	DWord	☐	☑	Is set as soon the unit prog/mode change to the target program present in Set_Cur_Prog should start (value <> 0 = active, value = 0 passiv)
00252	SIE_Cmd_Mach_Speed	REAL	☐	☑	Set point of machine speed in primary units/minute in the installed environment based on currently processed products
00350	SIE_Cntrl_Cmd	DWord	☐	☑	State command to drive a state change in the Base State Model
00351	SIE_Cmd_Change_Req	DWord	☐	☑	Commands to proceed the state change as soon as it is set to 1
00352	SIE_LCU_Cntrl_Active	DWord	☐	☑	RemoteControlActive indicates line controller is controlling the machine from external.
00032	SIE_Ver_LCU	String16[10]	☐	☑	PDI version info. “PDI V2.0.0” fix for this implementation
00033	SIE_Ver_Proj_LCU	String16[10]	☐	☐	Project specific version
00353	SIE_State_Requested	DWORD	☐	☑	As soon as the state change command is set (CntrlCmd = valid value and CmdChangeRequest= 1) the StateRequested value indicates the numerical value of target state
00354	SIE_State_Change_Act	DWord	☐	☑	Indicates a state change initiated by CmdChangeRequest is in progress.
41000	SIE_Buffer_Infeed	DINT	☐	☐	MachBufferEntry in % from 0 to 100 (optional)
41001	SIE_Buffer_Discharge	DINT	☐	☐	MachBufferExit in % from 0 to 100 (optional)
00355	SIE_LCU_Allow_Cntrl	DWord	☐	☑	RemoteControlAllowed indicates if line controller / operator is allowed to control the machine from external command

NOTE The tags “SIE_Set_Cur_Prog” and “SIE_Prog_Change_Req” are added for future use und will not be used in this version.

2.2.2 Detailed interface description

SIE_Set_Cur_Prog

Par.Nr.	Name	Type	Comment
00250	SIE_Set_Cur_Prog	DWORD	Target program for the machine requested by the line system for this machine

"SIE_Set_Cur_Prog" (Unit mode) target program for the machine requested by the line system for this machine. This value is predefined by the user/OEM, and stands for the desired programs of the machine. The "SIE_Set_Cur_Prog" tag is a numerical representation of the mode to be set. There can be any number of unit modes, and for each equipment program there is an accompanying state model.

SIE_Prog_Change_Req

Par.Nr.	Name	Type	Comment
00251	SIE_Prog_Change_Req	DWORD	Change request of the target program

Is set as soon the unit prog/mode change to the target program present in "SIE_Set_Cur_Prog" should start (value <> 0 = active, value = 0 passive. When a unit change request takes place a numerical value must be present in the "SIE_Set_Cur_Prog" tag to change the program of the equipment. Local processing and conditioning of the requested change is necessary in order to accept, reject, or condition the timing of the change request.

SIE_Cmd_Mach_Speed

Par.Nr.	Name	Type	Comment
00252	SIE_Cmd_Mach_Speed	REAL	Set point of machine speed in primary pieces per minute

The value defines the set point send by PLC for current speed of the machine in primary pieces per minute.

SIE_Cntrl_Cmd

Par.Nr.	Name	Type	Comment
00350	SIE_Cntrl_Cmd	DWORD	State change command

The tag holds the command that provides the state command to drive a state change in the Base State Model.

Command	Bit Nr.	Value		From current state		To new state
		Binary	Integer			
Reset	0	00000000 00000001	1	Stop	→	Resetting
Start	1	00000000 00000010	2	Idle	→	Starting
Stop	2	00000000 00000100	4	Resetting Idle Starting Operating Suspending Unsuspending Prepared Lack (Branchline) Tailback (Branchline) Holding Un-holding Held Equipment failure External failure	→	Stopping
Hold	3	00000000 00001000	8	Operating Starting Unsuspending Suspending Prepared Lack (Branchline) Tailback (Branchline)	→	Holding
Unhold	4	00000000 00010000	16	Held Equipment failure External failure	→	Un-holding
Suspend	5	00000000 00100000	32	Operating	→	Suspending
Unsuspend	6	00000000 01000000	64	Suspended Prepared Lack (Branchline) Tailback (Branchline)	→	Unsuspending
Abort	7	00000000 10000000	128	Any	→	Aborting
Clear	8	00000001 00000000	256	Emergency Stop	→	Clearing

SIE_Cmd_Change_Req

Par.Nr.	Name	Type	Comment
00351	SIE_Cmd_Change_Req	DWORD	Proceed a state change

The tag commands the machine to proceed a state change to the target state requested in “SIE_Cntrl_Cmd”.

SIE_LCU_Cntrl_Active

Par.Nr.	Name	Type	Comment
00352	SIE_LCU_Cntrl_Active	DWORD	Remote control is active

The tag tells the machine if remote control is successfully enabled for this machine.

SIE_State_Requested

Par.Nr.	Name	Type	Comment
00353	SIE_State_Requested	DWORD	State transition checking

The tag is used for state transition checking to ensure that a target state can be transitioned to. It can contain the same numerical value as the tag “StateCurrent”.

SIE_Ver_LCU

Par.Nr.	Name	Type	Comment
00032	SIE_Ver_LCU	String16	Vendor specific version description

This data point provides a vendor specific version description of the WS interface implementation. “PDI_V2.0.0” is fixed for this implementation. The provided DBs are already predefined with this name.

SIE_Ver_Proj_LCU

Par.Nr.	Name	Type	Comment
00033	SIE_Ver_Proj_LCU	String16	Project specific version description

This data point provides a project specific version description of the WS interface implementation. Regarding the content there are no specifications determined.

SIE_State_Change_Act

Par.Nr.	Name	Type	Comment
00354	SIE_State_Change_Act	DWORD	Shows active state change

The value indicates if a change of a state is in progress in the machine. Value is 1, as long as a state change is active and 0 if it is done.

SIE_Buffer_Infeed

Par.Nr.	Name	Type	Comment
41000	SIE_Buffer_Infeed	DINT	Filling of the infeed buffer in percent

The tag contains the current filling of the infeed buffer in percent with one decimal place. It indicates the current fill-level in % of the machine entry buffer between 0% (empty) and 100% (full). Valid values are all REAL numbers from 0 to 100. In case no buffer sensor is available or the buffer fill-level is controlled by an external buffer controller the value is set to -1.

SIE_Buffer_Discharge

Par.Nr.	Name	Type	Comment
41001	SIE_Buffer_Discharge	DINT	Filling of the discharge buffer in percent

The tag contains the current filling of the discharge buffer in percent with one decimal place. It indicates the current fill-level in % of the machine entry buffer between 0% (empty) and 100% (full). Valid values are all REAL numbers from 0 to 100. In case no buffer sensor is available or the buffer fill-level is controlled by an external buffer controller the value is set to -1.

SIE_LCU_Allow_Cntrl

Par.Nr.	Name	Type	Comment
00355	SIE_LCU_Allow_Cntrl	DINT	Enabling remote control from operator

The tag enables remote control from machine operator. It indicates if line controller/operator is allowed to control the machine from external command. (1 = enabled, 0 = disabled).

2.3 PDI PEC

The PEC provides additional data for energy monitoring and on top level to support implementation of a corporate energy data management system with following objectives:

- Compliance and support of national and international sustainability programs and standards, like ISO50001
- Continuous improvement of energy and water conservation
- Reduce costs for procurement of energy and water
- Increase employee awareness for energy efficiency

All data exchanged with the PDI-PEC between line HMI (PSS) and the OEM PLC are tag based and can be polled by upper level systems at any time.

NOTE Implementation of the PDI PEC is optional.

2.3.1 Interface description overview

This interface based on Weihenstephan Standards V08.

Parameter Number	Parameter Name	Type	WS	Man-datory	Description
00034	SIE_Ver_PEC	String16[10]	☐	☑	PDI version info. “PDI_V2.0.0” fix for this implementation
00035	SIE_Ver_Proj_PEC	String16[10]	☐	☐	Project specific version
45101	SIE_EngyTypeID_1	DINT	☐	☑	Type of Energy, Number according to predefined ID List (see definition table)
45111	SIE_EngyCurCons_1	REAL	☐	☑	Current consumption [kW, m³/h, kg/h, l/h]
45121	SIE_EngyCurConsUoM_1	DINT	☐	☐	Measure ID of current Energy consumption (according the SI Unit of Measure ID List)
45131	SIE_EngyCount_1	REAL	☐	☐	Accumulating counter (meter) in kWh, m³, kg, l], defined Overflow
45141	SIE_EngyCountUoM_1	DINT	☐	☐	Measure ID of current Energy consumption (according the SI Unit of Measure ID List)
45102	SIE_EngyTypeID_2	DINT	☐	☑	Type of Energy, Number according to predefined ID List (see definition table)
45112	SIE_EngyCurCons_2	REAL	☐	☑	Current consumption [kW, m³/h, kg/h, l/h]
45122	SIE_EngyCurConsUoM_2	DINT	☐	☐	Measure ID of current Energy consumption (according the SI Unit of Measure ID List)
45132	SIE_EngyCount_2	REAL	☐	☐	Accumulating counter (meter) in kWh, m³, kg, l], defined Overflow
45142	SIE_EngyCountUoM_2	DINT	☐	☐	Measure ID of current Energy consumption (according the SI Unit of Measure ID List)
45103	SIE_EngyTypeID_3	DINT	☐	☑	Type of Energy, Number according to predefined ID List (see definition table)
45113	SIE_EngyCurCons_3	REAL	☐	☑	Current consumption [kW, m³/h, kg/h, l/h]
45123	SIE_EngyCurConsUoM_3	DINT	☐	☐	Measure ID of current Energy consumption (according the SI Unit of Measure ID List)
45133	SIE_EngyCount_3	REAL	☐	☐	Accumulating counter (meter) in kWh, m³, kg, l], defined Overflow
45143	SIE_EngyCountUoM_3	DINT	☐	☐	Measure ID of current Energy consumption (according the SI Unit of Measure ID List)
45104	SIE_EngyTypeID_4	DINT	☐	☑	Type of Energy, Number according to predefined ID List (see definition table)
45114	SIE_EngyCurCons_4	REAL	☐	☑	Current consumption [kW, m³/h, kg/h, l/h]
45124	SIE_EngyCurConsUoM_4	DINT	☐	☐	Measure ID of current Energy consumption (according the SI Unit of Measure ID List)
45134	SIE_EngyCount_4	REAL	☐	☐	Accumulating counter (meter) in kWh, m³, kg, l], defined Overflow

Parameter Number	Parameter Name	Type	WS	Man-datory	Description
45144	SIE_EngyCountUoM_4	DINT	☐	☐	Measure ID of current Energy consumption (according the SI Unit of Measure ID List)
45105	SIE_EngyTypeID_5	DINT	☐	☑	Type of Energy, Number according to predefined ID List (see definition table)
45115	SIE_EngyCurCons_5	REAL	☐	☑	Current consumption [kW, m³/h, kg/h, l/h]
45125	SIE_EngyCurConsUoM_5	DINT	☐	☐	Measure ID of current Energy consumption (according the SI Unit of Measure ID List)
45135	SIE_EngyCount_5	REAL	☐	☐	Accumulating counter (meter) in kWh, m³, kg, l], defined Overflow

2.3.2 Detailed interface description

SIE_Ver_PEC

Par.Nr.	Name	Type	Comment
00034	SIE_Ver_PEC	String16[10]	Vendor specific version description

This data point provides a vendor specific version description of the WS interface implementation. “PDI_V2.0.0” is fixed for this implementation. The provided DBs are already predefined with this name.

SIE_Ver_Proj_PEC

Par.Nr.	Name	Type	Comment
00035	SIE_Ver_Proj_PEC	String16[10]	Project specific version description

This data point provides a project specific version description of the WS interface implementation. Regarding the content there are no specifications determined.

SIE_EngyTypeID_x

Par.Nr.	Name	Type	Comment
45101	SIE_EngyTypeID_1	DINT	Type of Energy
45102	SIE_EngyTypeID_2		
45103	SIE_EngyTypeID_3		
45104	SIE_EngyTypeID_4		
45105	SIE_EngyTypeID_5		

The tags define the type of energy being measured. It is a numerical representation of the energy type according to the predefined ID list.

ID	Base unit	Base unit CurCons	Description
00000	-	-	Undefined (Defined in SCADA)
00001	m^3	m^3/h	Water
00002	m^3	m^3/h	Air
00003	m^3	m^3/h	Gas
00004	kWh	kW	Electricity
00005	KG	KG/h	Steam

SIE_EngyCurCons_x

Par.Nr.	Name	Type	Comment
45111	SIE_EngyCurCons_1	REAL	Current energy consumption
45112	SIE_EngyCurCons_2		
45113	SIE_EngyCurCons_3		
45114	SIE_EngyCurCons_4		
45115	SIE_EngyCurCons_5		

The tags contains the value for the current consumption. Depending on the value of “SIE_EngyCurConsUoM_x” the appropriate unit is either kW, m³/h, kg/h or l/h.

SIE_EngyCurConsUoM_x

Par.Nr.	Name	Type	Comment
45121	SIE_EngyCurConsUoM_1	DINT	Unit of Measurement (UoM) ID
45122	SIE_EngyCurConsUoM_2		
45123	SIE_EngyCurConsUoM_3		
45124	SIE_EngyCurConsUoM_4		
45125	SIE_EngyCurConsUoM_5		

The values represent the unit of the measured consumption of energy. It is a numerical representation of the unit given in the ID list.

TIA@FuB UoM ID	Type ID	Symbol	Coversion Factor	Quantity	Description
3362	5	kg/s	kg/s	mass flow rate	kilogram per second
3378	5	kg/d	$1{,}157\ 41 \times 10^{-5}$ kg x s^{-1}	mass flow rate	kilogram per day
3381	5	kg/h	$2{,}777\ 78 \times 10^{-4}$ kg x s^{-1}	mass flow rate	kilogram per hour
3384	5	kg/min	$1{,}666\ 67 \times 10^{-2}$ kg x s^{-1}	mass flow rate	kilogram per minute
3401	5	ton (US) /h	$2{,}519\ 958 \times 10^{-1}$ kg/s	mass flow rate	ton (US) per hour
3402	5	lb/h	$1{,}259\ 979 \times 10^{-4}$ kg/s	mass flow rate	pound per hour
3420	5	t/d	$1{,}157\ 41 \times 10^{-2}$ kg/s	mass flow rate	tonne per day
3423	5	t/h	$2{,}777\ 78 \times 10^{-1}$ kg/s	mass flow rate	tonne per hour
3426	5	t/min	16,666 7 kg/s	mass flow rate	tonne per minute
3429	5	t/s	10^3 kg/s	mass flow rate	tonne per second
3438	5	klb/h	0,125 997 889 kg/s	mass flow rate	kilopound per hour
3444	1, 2, 3	m³/s	m³/s	volume flow rate	cubic metre per second

TIA@FuB UoM ID	Type ID	Symbol	Coversion Factor	Quantity	Description
3445	1, 2, 3	m³/h	2,777 78 x 10^{-4} m³/s	volume flow rate	cubic metre per hour
3452	1, 2, 3	cm³/d	1,157 41 × 10^{-11} m³ x s^{-1}	volume flow rate	cubic centimetre per day
3455	1, 2, 3	cm³/h	2,777 78 × 10^{-10} m³ x s^{-1}	volume flow rate	cubic centimetre per hour
3464	1, 2, 3	m³/d	1,157 41 × 10^{-5} m³ x s^{-1}	volume flow rate	cubic metre per day
3469	1, 2, 3	m³/min	1,666 67 × 10^{-2} m³ x s^{-1}	volume flow rate	cubic metre per minute
3493	1, 2, 3	ft³/h	7,865 79 x 10^{-6} m³/s	volume flow rate	cubic foot per hour
3494	1, 2, 3	ft³/min	4,719 474 x 10^{-4} m³/s	volume flow rate	cubic foot per minute
3495	1, 2, 3	barrel (US)/min	2,649 79 x 10^{-3} m³/s	volume flow rate	barrel (US) per minute
5178	4	J/s	W	power (for direct current), active power	joule per second
5179	4	kW	10^3 W	power (for direct current), active power	kilowatt
5180	4	MW	10^6 W	power (for direct current), active power	megawatt
5183	4	mW	10^{-3} W	power (for direct current), active power	milliwatt
5184	4	J/min	1,666 67 × 10^{-2} W	power (for direct current), active power	joule per minute
5185	4	J/h	2,777 78 × 10^{-4} W	power (for direct current), active power	joule per hour
5186	4	J/d	1,157 41 × 10^{-5} W	power (for direct current), active power	joule per day
5189	4	kJ/h	2,777 78 x 10^{-1} W	power (for direct current), active power	kilojoule per hour
5190	4	kJ/d	1,157 41 x 10^{-2} W	power (for direct current), active power	kilojoule per day

SIE_EngyCount_x

Par.Nr.	Name	Type	Comment
45131	SIE_EngyCount_1	REAL	Accumulating counter of energy meter
45132	SIE_EngyCount_2		
45133	SIE_EngyCount_3		
45134	SIE_EngyCount_4		
45135	SIE_EngyCount_5		

The Tags contains an accumulating counter of an energy meter.

The value starts counting as soon the meter counts. There is an overflow at 9.999.999,99 and the value starts again at 0. No decimal places are allowed. There is no reset in between.

This value has to be retained during PLC start/stop and PLC power off.

SIE_EngyCountUoM_x

Par.Nr.	Name	Type	Comment
45141	SIE_EngyCountUoM_1	DINT	Accumulating counter of energy meter
45142	SIE_EngyCountUoM_2		
45143	SIE_EngyCountUoM_3		
45144	SIE_EngyCountUoM_4		
45145	SIE_EngyCountUoM_5		

The value defines the unit of measure for the accumulating energy counter. The DINT value of the tag is related to the unit in the corresponding ID list.

TIA@FuB UoM ID	Type ID	Symbol	Coversion Factor	Quantity	Description
1082	1, 2, 3	m^3	m^3	volume	cubic metre
1084	1, 2, 3	l	10^{-3} m^3	volume	litre
1086	1, 2, 3	cm^3	10^{-6} m^3	volume	cubic centimetre
1087	1, 2, 3	dm^3	10^{-3} m^3	volume	cubic decimetre
1089	1, 2, 3	hl	10^{-1} m^3	volume	hectolitre
1104	1, 2, 3	in^3	16,387 064 x 10^{-6} m^3	volume	cubic inch
1106	1, 2, 3	yd^3	0,764 555 m^3	volume	cubic yard
1107	1, 2, 3	gal (UK)	4,546 092 x 10^{-3} m^3	volume	gallon (UK)
1108	1, 2, 3	gal (US)	3,785 412 x 10^{-3} m^3	volume	gallon (US)
1127	1, 2, 3	fl oz (US)	2,957 353 x 10^{-5} m^3	volume	fluid ounce (US)
3002	5	kg	kg	mass	kilogram
3008	5	t	10^3 kg	mass	tonne (metric ton)
3014	5	lb	0,453 592 37 kg	mass	pound
3320	4	J	J	work, energy, potential energy	joule
3321	4	kJ	10^3 J	work, energy, potential energy	kilojoule
3326	4	MJ	10^6 J	work, energy, potential energy	megajoule
3330	4	W·h	3,6 x 10^3 J	work, energy, potential energy	watt hour
3331	4	MW·h	3,6 x 10^9 J	work, energy, potential energy	megawatt hour (1000 kW.h)
3332	4	kW·h	3,6 x 10^6 J	work, energy, potential energy	kilowatt hour

2.4 PDI Para

The PDI-Para interface provides additional data for machine specific parameters. The information can be delivered as Boolean, Integer, Real or String values. The delivered information's contain typically process, order or reporting information's.

All data exchanged with the PDI-Para between line HMI (PSS) and the OEM PLC are tag based and can be polled by upper level systems at any time.

2.4.1 Interface description overview

The Interface based on Weihenstephan Standards V06.

Par. Nr.	Parameter Name	Type (SIMATIC)	WS	Man-datory	Description
00036	SIE_Ver_Para	String16[10]	☐	☑	PDI version info. "PDI_V2.0.0" fix for this implementation
00037	SIE_Ver_Proj_Para	String16[10]	☐	☐	Project specific version
31001	SIE_Para_UNSIGNED_1	DINT	☐	☐	Parameter value -DINT
31002	SIE_Para_UNSIGNED_2	DINT	☐	☐	Parameter value -DINT
31003	SIE_Para_UNSIGNED_3	DINT	☐	☐	Parameter value -DINT
31004	SIE_Para_UNSIGNED_4	DINT	☐	☐	Parameter value -DINT
31005	SIE_Para_UNSIGNED_5	DINT	☐	☐	Parameter value -DINT
31006	SIE_Para_UNSIGNED_6	DINT	☐	☐	Parameter value -DINT
31011	SIE_Para_REAL_1	REAL	☐	☐	Parameter value - REAL
31012	SIE_Para_REAL_2	REAL	☐	☐	Parameter value - REAL
31013	SIE_Para_REAL_3	REAL	☐	☐	Parameter value - REAL
31014	SIE_Para_REAL_4	REAL	☐	☐	Parameter value - REAL
31015	SIE_Para_REAL_5	REAL	☐	☐	Parameter value - REAL
31016	SIE_Para_REAL_6	REAL	☐	☐	Parameter value - REAL
31021	SIE_Para_STR_1	String[32]	☐	☐	Parameter value – String [32]
31022	SIE_Para_STR_2	String[32]	☐	☐	Parameter value – String [32]

2.4.2 Detailed interface description

SIE_Ver_Para

Par.Nr.	Name	Type	Comment
00036	SIE_Ver_PEC	String16[10]	Vendor specific version description

This data point provides a vendor specific version description of the WS interface implementation. “PDI_V2.0.0” is fixed for this implementation. The provided DBs are already predefined with this name.

SIE_Ver_Proj_Para

Par.Nr.	Name	Type	Comment
00037	SIE_Ver_Proj_PEC	String16[10]	Project specific version description

This data point provides a project specific version description of the WS interface implementation. Regarding the content there are no specifications determined.

SIE_Para_UNSIGNED_x

Par.Nr.	Name	Type	Comment
31001	SIE_Para_UNSIGNED_1	DINT	Machine specific information
31002	SIE_Para_UNSIGNED_2		
31003	SIE_Para_UNSIGNED_3		
31004	SIE_Para_UNSIGNED_4		
31005	SIE_Para_UNSIGNED_5		
31006	SIE_Para_UNSIGNED_6		

The tags containing machine specific information of the data type DINT. Six tags are set up as placeholder for additional parameters of the data type DINT.

SIE_Para_REAL_x

Par.Nr.	Name	Type	Comment
31011	SIE_Para_REAL_1	REAL	Machine specific information
31012	SIE_Para_REAL_2		
31013	SIE_Para_REAL_3		
31014	SIE_Para_REAL_4		
31015	SIE_Para_REAL_5		
31016	SIE_Para_REAL_6		

The Tags containing machine specific information of the data type REAL. Six tags are set up as placeholder for additional parameters of the data type REAL.

SIE_Para_STR_x

Par.Nr.	Name	Type	Comment
31021	SIE_Para_STR_1	STRING	Additional textual information
31022	SIE_Para_STR_2		

The tags give additional textual information. Two tags are available as parameters of the data type STRING.

3 General PDI Information

3.1 Technical Implementation

All technical implementation templates are available for download. The templates are stored in different folders, one for each destination system.

Downloads regarding the PDI interface:

- STEP 7 Source files → for creating S7-3xx and S7-4xx data blocks
- TIA Portal Library → for creating S7-1x00 data blocks
- SIMOTION Source Files → for SIMOTION data blocks usable in SCOUT

Here you can download the files:

https://support.industry.siemens.com/cs/ww/en/view/86302104

3.1.1 STEP 7 (S7-300 / S7-400)

The source files (STL) are available as STEP 7 source files. The source files include Version 2.0 of the data block source in STL as well as an UDT as SCL source.

- DB_PDI_WS_BASIC_V2.awl
- DB_PDI_WS_LCU_V2. awl
- DB_PDI_WS_Para_V2. awl
- DB_PDI_WS_PEC_V2. awl
- UDT_PDI_WS_BASIC_WS_V2.scl
- UDT_PDI_WS _LCU _V2.scl
- UDT_PDI_WS _Para _V2.scl
- UDT_PDI_WS _PEC _V2.scl

All sources can be found in the STEP 7 Source Files “STEP7_Source_Files_PDI_WS_V2.zip” folder.

In order to use this files STEP 7 V5.5 SP3 is recommended.

3.1.2 TIA Portal (S7-300 / S7-400 / S7-1200 / S7-1500)

The TIA Portal library “PDI_WS_V2.al13” is available in the zip-file “TIA_Portal_Library_WS_V2_0.zip” includes the data blocks and UDTs for PDI Basic, PDI LCU, PDI PEC and PDI Para.

A short step-by-step description is included that shows how to import the TIA Portal library PDI_WS_V2.al13

In order to use those files TIA Portal Professional V13 SP1 is required.

3.1.3 SIMOTION SCOUT

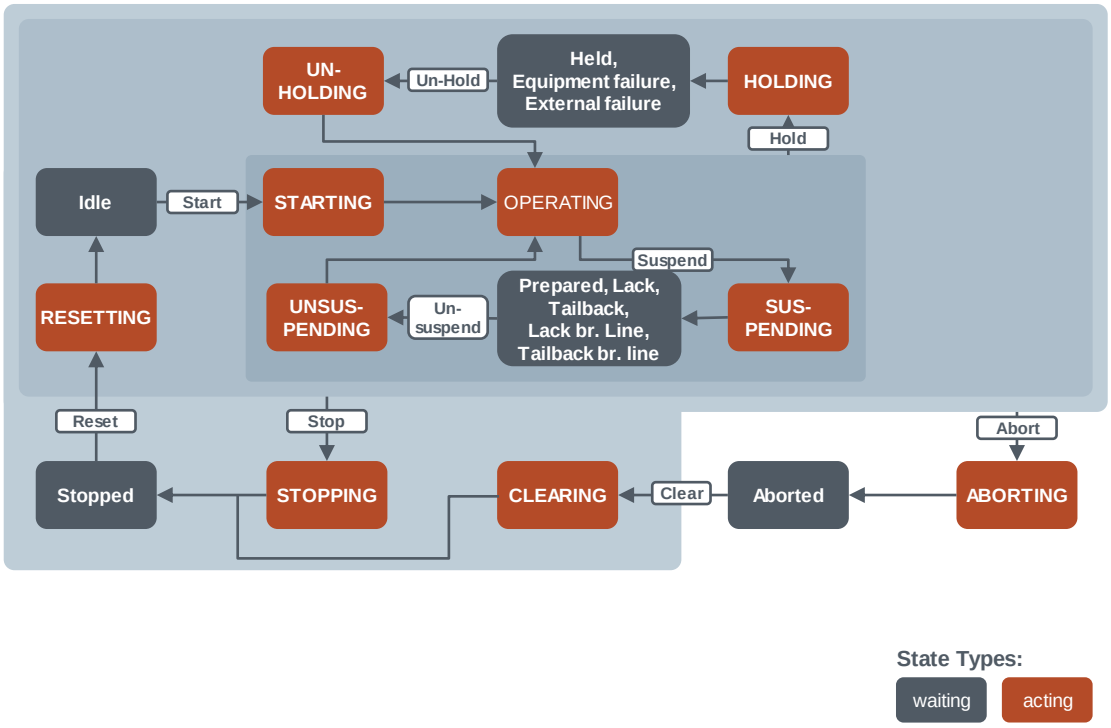
The Basic PDI interface for SIMOTION Scout is available as xml export file. A short description how to create the needed STI/ATI-file(s) for use with SIMATIC Net OPC Server is available in SIMATIC Net OPC folder.

In order to use this files SCOUT 4.4 or higher is required.

3.2 State description

For more details please see original source /1/

Weihenstephan Standards for Production Data Acquisition. WS Pack Specification of the Interface content (Part 2) Version 08



Stopped

The machine has electric power, but is in a stationary state. This state allows the machine to communicate, but it is not yet initialized or ready to carry out its intended function.

Starting

The machine is in production start. This is not to be confused with the program "Start up". An example might be the self-test of a packing robot, which tests the functionality of the individual servo motors through a movement test.

Prepared

The machine is ready to carry out its intended function. However, it is in a waiting state which was not recognized as a lack or tailback state and can automatically start again.

Lack

The machine is not carrying out its intended function due to a lack detected by the sensor system in the inlet of the machine (Machine Stop). In machines which have multiple inlets, the lack state concerns the main inlet, namely concerns the goods (bottles, crates) which are transported to the filling machine (Main machine) or from the filling machine. The lack in the inlet is an external failure, however due to its importance for the visualization and the technical report it is recorded separately.

Tailback

The machine is not carrying out its intended function due to a tailback detected by the sensor system in the outlet of the machine (Machine Stop). In machines which have multiple outlets, the tailback state concerns the main outlet, namely concerns the goods (bottles, crates) which are transported to the filling machine (main machine) or from the filling machine. The tailback in the outlet is an external failure, however due to its importance for the visualization and the technical reporting it is recorded separately.

Lack/ Tailback Branch Line

The machine is not carrying out its intended function due to a lack in the secondary inlet or tailback in the secondary the outlet of the machine (Machine Stop). This state can only occur in machines which have 2 inlets or outlets, whereby the secondary flow leads to or from a downstream or upstream machine in the filling system (packing or palletizing machine). The secondary flow concerns the goods (e.g. packaged good, packaging, packaging aid) which are transported away from the filling machine (main machine). The lack/ tailback in the secondary flow is an external failure, however due to its importance for the visualization and the technical reporting it is recorded separately.

Lacks/Tailbacks caused by other media (e.g. lack of compressed air) not processed in another machine of the packaging plant does not follow the stat Lack or Tailback.

Operating

The machine is carrying out its intended function (DIN EN 292-1).

Stopping

The machine is being transferred to the stopped state (Stopped) by a controlled stop routine. This is not to be confused with the program “Production Startup / Run Down”. Rather it concerns the internal machine routines for reaching a stationary state. An example would be the positioning of the packing head of a packing robot in the park position.

Aborting

The machine is in the time period between the occurrence of the failure and the resulting end state (Emergency Stop).

Equipment failure

Failure, which occurs in the machine itself and leads to a machine stop (in accordance with DIN 8782). In the operating state ‘Equipment Failure’ the machine does not carry out its intended function (Machine Stop) due to an unpermitted deviation from SET-state (Failure notice). The unpermitted deviation is parameterized in the controls as equipment failure.

External failure

A failure which is not attributable to the machine but which nonetheless leads to a machine stop (in accordance with DIN 8782). In the operating state ‘External Failure’, the machine does not carry out its intended function (Machine Stop) due to an unpermitted deviation from the SET-state (Failure notice) detected by the control system sensors. The unpermitted deviation is parameterized in the controls as an external failure. The external failures ‘Lack, Tailback and Lack/Tailback in Branch Line’ are recorded separately and therefore are not assigned to this operation state. Other lack or tailback situations are however considered ‘External Failures’ (E.g. lack of compressed air).

Emergency Stop

State that occurs after pressing the emergency stop switch or the activation of another safety guard of a machine (E.g. door in safety circuit). A “safe mode” (Safe motion), in which a machine continues to operate does not match the state Emergency Stop.

Holding

The machine is in the time period between the holding being started by the operator and the resulting end state (Held, Equipment Failure, External Failure).

Held

The machine is not carrying out its intended function due to an unpermitted deviation from the SET state detected by a control system sensor. The operator intervenes and stops the machine manually (E.g. by handoff). The cause of failure is classed by the operator as either equipment failure or external failure.

Idle

The machine is ready to carry out its intended function. It is however in a waiting state and must first be brought into operation by the operators or by external automatic release.

Unholding

The machine is in the time period between the release of Held (Held, Equipment Failure, External Failure) by the operator and the resulting end state (Operating).

Suspending

The machine is in the time period between the release of Suspending and the resulting end state (Prepared, Lack, Tailback, Lack Branch Line or Tailback Branch Line).

Unsuspending

The machine is in the time period between the release of being Suspended (Prepared, Lack, Tailback, Lack Branch Line or Tailback Branch Line) and the resulting end state (Operating).

Resetting

The machine is in the time period between the release after a stop (Stopped) and the resulting end state (Idle).

Clearing

The machine is in the time period between the release after an Emergency Stop by the operator and the resulting end state (Stopped).

3.3 Cross naming reference (system wide)

The table below shows the naming conventions in regards to the different standards and the implemented naming within the various components of the SIEMENS plant wide automation architecture.

The column “Name based on OMAC” gives the identifier as defined by the ISA TR88.00.02 standard. To simplify the comparison between the Weihenstephan Standard V06 and the ISA TR88.00.02 standard, the column “Name based on Weihenstephan” is provided. In all system packages needed for a plant wide automation where the implementation of both OMAC and Weihenstephan standards requires abstract naming conventions, neutral naming is useful. Therefore, the use of the abstract names as provided in column “Naming on WinCC” is highly recommended.

Name based on OMAC	Name based on Weihenstephan	Name in WinCC
Status.PDIVersion	SIE_Ver_Basic	PDI_Version
Status.ProjectVersion	SIE_Ver_Proj_Basic	Project_Version
Status.UnitModeCurrent	WS_Cur_Prog	Current_Mode
Status.StateCurrent	WS_Cur_State	Current_State
Status.MachSpeed	WS_Set_Mach_Spd	Setpoint_Speed
Status.CurMachSpeed	WS_Cur_Mach_Spd	Current_Speed
Status.EquipmentInterlock.Blocked	-	Equipment_Interlock_Blocked
Status.EquipmentInterlock.Starved	-	Equipment_Interlock_Starved
Status.Parameter0.Value	SIE_Mach_Cum_Time	Power_Up_Time
Status.Parameter1.Value	WS_Cons_Electricity	Consumed_Energy
Status.Parameter2.Value	WS_Prod_Ratio	Product_Ratio
Status.Parameter3.Value	SIE_Prod_Ratio_Typ	Product_Ratio_Type
Status.LightStack	SIE_Light_Stack	Light_Stack
Admin.ProdProcessedCount[0].Count	SIE_Tot_Packages	All_Processed_Counter_Resettable
Admin.ProdProcessedCount[0].AccCount	WS_Tot_Packages	All_Processed_Counter_Non_Resettable
Admin.ProdDefectiveCount[0].Count	SIE_Bad_Packages	Defect_Counter_Resettable
Admin.ProdDefectiveCount[0].AccCount	WS_Bad_Packages	Defect_Counter_Non_Resettable
Admin.MachDesignSpeed	WS_Mach_Design_Spd	Design_Speed
Admin.StopReason.ID	SIE_Not_Of_Fail_Group	First_Fault
Admin.StopReason.Value	WS_Not_Of_Fail_Code	OEM_First_Fault
Command.UnitMode	SIE_Set_Cur_Prog	Set_Cur_Prog
Command.UnitModeChangeRequest	SIE_Prog_Change_Req	Prog_Change_Req
Command.MachSpeed	SIE_Cmd_Mach_Speed	Set_Mach_Speed
Command.CntrlCmd	SIE_Cntrl_Cmd	Cntrl_Cmd
Command.CmdChangeRequest	SIE_Cmd_Change_Req	Cmd_Change_Req
Command.Parameter0.Value	SIE_LCU_Cntrl_Active	LCU_Ctrl_Active
Status.PDIVersion	SIE_Ver_LCU	PDI_Version
Status.ProjectVersion	SIE_Ver_Proj_LCU	Project_Version

Name based on OMAC	Name based on Weihenstephan	Name in WinCC
Status.StateRequested	SIE_State_Requested	State_Requested
Status.StateChangeInProcess	SIE_State_Change_Act	State_Change_Act
Status.Parameter4.Value	SIE_Buffer_Infeed	Buffer_Infeed
Status.Parameter5.Value	SIE_Buffer_Discharge	Buffer_Discharge
Status.Parameter6.Value	SIE_LCU_Allow_Cntrl	LCU_Allow_Cntrl
Status.PDIVersion	SIE_Ver_PEC	PDI_Version
Status.ProjectVersion	SIE_Ver_Proj_PEC	Project_Version
Status.Energy[0].TypeID	SIE_EngyTypeID_1	S_Energy[0]TypeID
Status.Energy[0].CurCons	SIE_EngyCurCons_1	S_Energy[0]CurCons
Status.Energy[0].EngyCurConsUoM	SIE_EngyCurConsUoM_1	S_Energy[0]CurConsUoM
Status.Energy[0].Count	SIE_EngyCount_1	S_Energy[0]Count
Status.Energy[0].EngyCountUoM	SIE_EngyCountUoM_1	S_Energy[0]CountUoM
Status.Energy[1].TypeID	SIE_EngyTypeID_2	S_Energy[1]TypeID
Status.Energy[1].CurCons	SIE_EngyCurCons_2	S_Energy[1]CurCons
Status.Energy[1].EngyCurConsUoM	SIE_EngyCurConsUoM_2	S_Energy[1]CurConsUoM
Status.Energy[1].Count	SIE_EngyCount_2	S_Energy[1]Count
Status.Energy[1].EngyCountUoM	SIE_EngyCountUoM_2	S_Energy[1]CountUoM
Status.Energy[2].TypeID	SIE_EngyTypeID_3	S_Energy[2]TypeID
Status.Energy[2].CurCons	SIE_EngyCurCons_3	S_Energy[2]CurCons
Status.Energy[2].EngyCurConsUoM	SIE_EngyCurConsUoM_3	S_Energy[2]CurConsUoM
Status.Energy[2].Count	SIE_EngyCount_3	S_Energy[2]Count
Status.Energy[2].EngyCountUoM	SIE_EngyCountUoM_3	S_Energy[2]CountUoM
Status.Energy[3].TypeID	SIE_EngyTypeID_4	S_Energy[3]TypeID
Status.Energy[3].CurCons	SIE_EngyCurCons_4	S_Energy[3]CurCons
Status.Energy[3].EngyCurConsUoM	SIE_EngyCurConsUoM_4	S_Energy[3]CurConsUoM
Status.Energy[3].Count	SIE_EngyCount_4	S_Energy[3]Count
Status.Energy[3].EngyCountUoM	SIE_EngyCountUoM_4	S_Energy[3]CountUoM
Status.Energy[4].TypeID	SIE_EngyTypeID_5	S_Energy[4]TypeID
Status.Energy[4].CurCons	SIE_EngyCurCons_5	S_Energy[4]CurCons
Status.Energy[4].EngyCurConsUoM	SIE_EngyCurConsUoM_5	S_Energy[4]CurConsUoM
Status.Energy[4].Count	SIE_EngyCount_5	S_Energy[4]Count
Status.Energy[4].EngyCountUoM	SIE_EngyCountUoM_5	S_Energy[4]CountUoM
Status.PDIVersion	SIE_Ver_Para	PDI_Version
Status.ProjectVersion	SIE_Ver_Proj_Para	Project_Version

Name based on OMAC	Name based on Weihenstephan	Name in WinCC
Status.Parameter_DINT_Value[0]	SIE_Para_UNSIGNED_1	Parameter_DINT[0]_Value
Status.Parameter_DINT_Value[1]	SIE_Para_UNSIGNED_2	Parameter_DINT[1]_Value
Status.Parameter_DINT_Value[2]	SIE_Para_UNSIGNED_3	Parameter_DINT[2]_Value
Status.Parameter_DINT_Value[3]	SIE_Para_UNSIGNED_4	Parameter_DINT[3]_Value
Status.Parameter_DINT_Value[4]	SIE_Para_UNSIGNED_5	Parameter_DINT[4]_Value
Status.Parameter_DINT_Value[5]	SIE_Para_UNSIGNED_6	Parameter_DINT[5]_Value
Status.Parameter_REAL_Value[0]	SIE_Para_REAL_1	Parameter_REAL[0]_Value
Status.Parameter_REAL_Value[1]	SIE_Para_REAL_2	Parameter_REAL[1]_Value
Status.Parameter_REAL_Value[2]	SIE_Para_REAL_3	Parameter_REAL[2]_Value
Status.Parameter_REAL_Value[3]	SIE_Para_REAL_4	Parameter_REAL[3]_Value
Status.Parameter_REAL_Value[4]	SIE_Para_REAL_5	Parameter_REAL[4]_Value
Status.Parameter_REAL_Value[5]	SIE_Para_REAL_6	Parameter_REAL[5]_Value
Status.Parameter_BOOL_Value[0]	-	Parameter_BOOL[0]_Value
Status.Parameter_BOOL_Value[1]	-	Parameter_BOOL[1]_Value
Status.Parameter_BOOL_Value[2]	-	Parameter_BOOL[2]_Value
Status.Parameter_BOOL_Value[3]	-	Parameter_BOOL[3]_Value
Status.Parameter_BOOL_Value[4]	-	Parameter_BOOL[4]_Value
Status.Parameter_STR_Value[0]	SIE_Para_STR_1	Parameter_STR[0]_Value
Status.Parameter_STR_Value[1]	SIE_Para_STR_2	Parameter_STR[1]_Value

4 Abbreviations

Abbr.	Description
E2M	Energy to Monitor
F&B	Food and Beverage
HMI	Human Machine Interface
IF	Interface
KPI	Key Performance Indicator
LCU	Line Control Unit
LM	Line Monitoring
MES	Manufacturing Execution System
MOM	Manufacturing Operation Management
MTBF	Mean time between failures
MTTR	Mean time to repair
OEE	Overall Equipment Effectiveness
OEM	Original Equipment Manufacturer
OMAC	Organization for Machine Automation and Control
PARA	Parameters
PDA	Plant Data Acquisition
PDI	Plant Data Interface
PEC	Plant Energy Concept
PLC	Programmable Logic Controller
PSS	Plant Supervisory System
PWA	Plant Wide Automation
RCA	Root Cause Analysis
SCADA	Supervisory Control and Data Acquisition
TIA	Total Integrated Automation
UoM	Unit of Measurement

5 Related literature

	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Download page of this entry https://support.industry.siemens.com/cs/ww/en/view/86302104
\3\	Line Integration at the Food & Beverage Industry (Overview) https://support.industry.siemens.com/cs/ww/en/view/109483779
\4\	OMAC – The Organization for Machine Automation and Control http://omac.org/workgroups/packaging-workgroup/
\5\	Weihenstephan Standards for Production Data Acquisition http://www.weihenstephaner-standards.de/index.php?id=5&L=1 WS Pack specification of the interface content (Part 2) Version 8.
\6\	ANSI/ISA-TR88.00.02-2015 https://www.isa.org/ A Technical Report prepared by ISA and registered with ANSI Machine and Unit States: An implementation example of ANSI/ISA-88.00.01 Approved 26 October 2015

6 History

Version			Date	Changes
V1.0			02/2014	First issue
V2.0			05/2016	New version based on WS Pack Specification of the Interface content (Part 2) Version 08