

SIMATIC S7-1500, CPU 1516-3 PN/DP, CENTRAL PROCESSING UNIT WITH WORKING MEMORY 1 MB FOR PROGRAM AND 5 MB FOR DATA, 1. INTERFACE: PROFINET IRT WITH 2 PORT SWITCH, 2. INTERFACE: ETHERNET, 3. INTERFACE: PROFIBUS, 10 NS BIT-PERFORMANCE, SIMATIC MEMORY CARD NECESSARY

| General information                                                                                       |                        |
|-----------------------------------------------------------------------------------------------------------|------------------------|
| Product type designation                                                                                  | CPU 1516-3 PN/DP       |
| HW functional status                                                                                      | FS01                   |
| Firmware version                                                                                          | V1.8                   |
| Engineering with                                                                                          |                        |
| <ul style="list-style-type: none"> <li>STEP 7 TIA Portal configurable/integrated as of version</li> </ul> | V13 SP1 Update 4       |
| Configuration control                                                                                     |                        |
| via dataset                                                                                               | Yes                    |
| Display                                                                                                   |                        |
| Screen diagonal (cm)                                                                                      | 6.1 cm                 |
| Control elements                                                                                          |                        |
| Number of keys                                                                                            | 6                      |
| Mode selector switch                                                                                      | 1                      |
| Supply voltage                                                                                            |                        |
| Type of supply voltage                                                                                    | 24 V DC                |
| permissible range, lower limit (DC)                                                                       | 19.2 V                 |
| permissible range, upper limit (DC)                                                                       | 28.8 V                 |
| Reverse polarity protection                                                                               | Yes                    |
| Mains buffering                                                                                           |                        |
| <ul style="list-style-type: none"> <li>Mains/voltage failure stored energy time</li> </ul>                | 5 ms                   |
| Input current                                                                                             |                        |
| Current consumption (rated value)                                                                         | 0.85 A                 |
| Inrush current, max.                                                                                      | 2.4 A; Rated value     |
| $I^2t$                                                                                                    | 0.02 A <sup>2</sup> ·s |
| Power                                                                                                     |                        |
| Power consumption from the backplane bus (balanced)                                                       | 6.7 W                  |
| Infeed power to the backplane bus                                                                         | 12 W                   |
| Power loss                                                                                                |                        |

|                                              |                                                                                                                                                       |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power loss, typ.                             | 7 W                                                                                                                                                   |
| <b>Memory</b>                                |                                                                                                                                                       |
| SIMATIC Memory Card required                 | Yes                                                                                                                                                   |
| <b>Work memory</b>                           |                                                                                                                                                       |
| • integrated (for program)                   | 1 Mbyte                                                                                                                                               |
| • integrated (for data)                      | 5 Mbyte                                                                                                                                               |
| <b>Load memory</b>                           |                                                                                                                                                       |
| • Plug-in (SIMATIC Memory Card), max.        | 32 Gbyte                                                                                                                                              |
| <b>Backup</b>                                |                                                                                                                                                       |
| • maintenance-free                           | Yes                                                                                                                                                   |
| <b>CPU processing times</b>                  |                                                                                                                                                       |
| for bit operations, typ.                     | 10 ns                                                                                                                                                 |
| for word operations, typ.                    | 12 ns                                                                                                                                                 |
| for fixed point arithmetic, typ.             | 16 ns                                                                                                                                                 |
| for floating point arithmetic, typ.          | 64 ns                                                                                                                                                 |
| <b>CPU-blocks</b>                            |                                                                                                                                                       |
| Number of elements (total)                   | 6 000; In addition to blocks such as DBs, FBs and FCs, UDTs, global constants, etc. are also regarded as elements                                     |
| <b>DB</b>                                    |                                                                                                                                                       |
| • Number range                               | 1 ... 60 999; subdivided into: number range that can be used by the user: 1 ... 59 999, and number range of DBs created via SFC 86: 60 000 ... 60 999 |
| • Size, max.                                 | 5 Mbyte; For non-optimized block accesses, the max. size of the DB is 64 KB                                                                           |
| <b>FB</b>                                    |                                                                                                                                                       |
| • Number range                               | 0 ... 65 535                                                                                                                                          |
| • Size, max.                                 | 512 kbyte                                                                                                                                             |
| <b>FC</b>                                    |                                                                                                                                                       |
| • Number range                               | 0 ... 65 535                                                                                                                                          |
| • Size, max.                                 | 512 kbyte                                                                                                                                             |
| <b>OB</b>                                    |                                                                                                                                                       |
| • Size, max.                                 | 512 kbyte                                                                                                                                             |
| • Number of free cycle OBs                   | 100                                                                                                                                                   |
| • Number of time alarm OBs                   | 20                                                                                                                                                    |
| • Number of delay alarm OBs                  | 20                                                                                                                                                    |
| • Number of cyclic interrupt OBs             | 20                                                                                                                                                    |
| • Number of process alarm OBs                | 50                                                                                                                                                    |
| • Number of DPV1 alarm OBs                   | 3                                                                                                                                                     |
| • Number of isochronous mode OBs             | 2                                                                                                                                                     |
| • Number of technology synchronous alarm OBs | 2                                                                                                                                                     |
| • Number of startup OBs                      | 100                                                                                                                                                   |
| • Number of asynchronous error OBs           | 4                                                                                                                                                     |

|                                                                   |                                                                                                                             |
|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| • Number of synchronous error OBs                                 | 2                                                                                                                           |
| • Number of diagnostic alarm OBs                                  | 1                                                                                                                           |
| Nesting depth                                                     |                                                                                                                             |
| • per priority class                                              | 24                                                                                                                          |
| Counters, timers and their retentivity                            |                                                                                                                             |
| S7 counter                                                        |                                                                                                                             |
| • Number                                                          | 2 048                                                                                                                       |
| Retentivity                                                       |                                                                                                                             |
| — adjustable                                                      | Yes                                                                                                                         |
| IEC counter                                                       |                                                                                                                             |
| • Number                                                          | Any (only limited by the main memory)                                                                                       |
| Retentivity                                                       |                                                                                                                             |
| — can be set                                                      | Yes                                                                                                                         |
| S7 timer                                                          |                                                                                                                             |
| • Number                                                          | 2 048                                                                                                                       |
| Retentivity                                                       |                                                                                                                             |
| — can be set                                                      | Yes                                                                                                                         |
| IEC timer                                                         |                                                                                                                             |
| • Number                                                          | Any (only limited by the main memory)                                                                                       |
| Retentivity                                                       |                                                                                                                             |
| — adjustable                                                      | Yes                                                                                                                         |
| Data areas and their retentivity                                  |                                                                                                                             |
| retentive data area in total (incl. times, counters, flags), max. | 512 kbyte; In total; available retentive memory for bit memories, timers, counters, DBs, and technology data (axes): 472 KB |
| Flag                                                              |                                                                                                                             |
| • Number, max.                                                    | 16 kbyte                                                                                                                    |
| • Number of clock memories                                        | 8                                                                                                                           |
| Data blocks                                                       |                                                                                                                             |
| • Retentivity adjustable                                          | Yes                                                                                                                         |
| • Retentivity preset                                              | No                                                                                                                          |
| Local data                                                        |                                                                                                                             |
| • per priority class, max.                                        | 64 kbyte; max. 16 KB per block                                                                                              |
| Address area                                                      |                                                                                                                             |
| Number of IO modules                                              | 8 192; max. number of modules / submodules                                                                                  |
| I/O address area                                                  |                                                                                                                             |
| • Inputs                                                          | 32 kbyte; All inputs are in the process image                                                                               |
| • Outputs                                                         | 32 kbyte; All outputs are in the process image                                                                              |
| per integrated IO subsystem                                       |                                                                                                                             |
| — Inputs (volume)                                                 | 8 kbyte                                                                                                                     |
| — Outputs (volume)                                                | 8 kbyte                                                                                                                     |
| per CM/CP                                                         |                                                                                                                             |

|                                     |                                                                                    |
|-------------------------------------|------------------------------------------------------------------------------------|
| — Inputs (volume)                   | 8 kbyte                                                                            |
| — Outputs (volume)                  | 8 kbyte                                                                            |
| <b>Subprocess images</b>            |                                                                                    |
| • Number of subprocess images, max. | 32                                                                                 |
| <b>Hardware configuration</b>       |                                                                                    |
| Number of hierarchical IO systems   | 20                                                                                 |
| <b>Number of DP masters</b>         |                                                                                    |
| • integrated                        | 1                                                                                  |
| • Via CM                            | 8; A maximum of 8 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total  |
| <b>Number of IO Controllers</b>     |                                                                                    |
| • integrated                        | 1                                                                                  |
| • via CM                            | 8; A maximum of 8 CMs/CPs (PROFIBUS, PROFINET, Ethernet) can be inserted in total  |
| <b>Rack</b>                         |                                                                                    |
| • Modules per rack, max.            | 32; CPU + 31 modules                                                               |
| • Rack, number of rows, max.        | 1                                                                                  |
| <b>PtP CM</b>                       |                                                                                    |
| • Number of PtP CMs                 | the number of connectable PtP CMs is only limited by the number of available slots |
| <b>Time of day</b>                  |                                                                                    |
| <b>Clock</b>                        |                                                                                    |
| • Type                              | Hardware clock                                                                     |
| • Backup time                       | 6 wk; At 40 °C ambient temperature, typically                                      |
| • Deviation per day, max.           | 10 s; Typ.: 2 s                                                                    |
| <b>Operating hours counter</b>      |                                                                                    |
| • Number                            | 16                                                                                 |
| <b>Clock synchronization</b>        |                                                                                    |
| • supported                         | Yes                                                                                |
| • to DP, master                     | Yes                                                                                |
| • in AS, master                     | Yes                                                                                |
| • in AS, slave                      | Yes                                                                                |
| • on Ethernet via NTP               | Yes                                                                                |
| <b>Interfaces</b>                   |                                                                                    |
| Number of PROFINET interfaces       | 2                                                                                  |
| Number of PROFIBUS interfaces       | 1                                                                                  |
| <b>1. Interface</b>                 |                                                                                    |
| <b>Interface types</b>              |                                                                                    |
| — Number of ports                   | 2                                                                                  |
| — integrated switch                 | Yes                                                                                |
| — RJ 45 (Ethernet)                  | Yes; X1                                                                            |

|                                                 |                                                                   |
|-------------------------------------------------|-------------------------------------------------------------------|
| Protocols                                       |                                                                   |
| — PROFINET IO Controller                        | Yes                                                               |
| — PROFINET IO Device                            | Yes                                                               |
| — SIMATIC communication                         | Yes                                                               |
| — Open IE communication                         | Yes                                                               |
| — Web server                                    | Yes                                                               |
| — Media redundancy                              | Yes                                                               |
| 2. Interface                                    |                                                                   |
| Interface types                                 |                                                                   |
| — Number of ports                               | 1                                                                 |
| — integrated switch                             | No                                                                |
| — RJ 45 (Ethernet)                              | Yes; X2                                                           |
| Protocols                                       |                                                                   |
| — PROFINET IO Controller                        | No                                                                |
| — PROFINET IO Device                            | No                                                                |
| — SIMATIC communication                         | Yes                                                               |
| — Open IE communication                         | Yes                                                               |
| — Web server                                    | Yes                                                               |
| 3. Interface                                    |                                                                   |
| Interface types                                 |                                                                   |
| — Number of ports                               | 1                                                                 |
| — RS 485                                        | Yes                                                               |
| Protocols                                       |                                                                   |
| — SIMATIC communication                         | Yes                                                               |
| — PROFIBUS DP master                            | Yes                                                               |
| — PROFIBUS DP slave                             | No                                                                |
| Interface types                                 |                                                                   |
| RJ 45 (Ethernet)                                |                                                                   |
| • 100 Mbps                                      | Yes                                                               |
| • Autonegotiation                               | Yes                                                               |
| • Autocrossing                                  | Yes                                                               |
| • Industrial Ethernet status LED                | Yes                                                               |
| RS 485                                          |                                                                   |
| • Transmission rate, max.                       | 12 Mbit/s                                                         |
| Protocols                                       |                                                                   |
| Number of connections                           |                                                                   |
| • Number of connections, max.                   | 256; via integrated interfaces of the CPU and connected CPs / CMs |
| • Number of connections reserved for ES/HMI/web | 10                                                                |

|                                                                                                                |                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| • Number of connections via integrated interfaces                                                              | 128                                                                                                                                                                    |
| • Number of S7 routing paths                                                                                   | 16                                                                                                                                                                     |
| <b>PROFINET IO Controller</b>                                                                                  |                                                                                                                                                                        |
| <b>Services</b>                                                                                                |                                                                                                                                                                        |
| — PG/OP communication                                                                                          | Yes                                                                                                                                                                    |
| — S7 routing                                                                                                   | Yes                                                                                                                                                                    |
| — Isochronous mode                                                                                             | Yes                                                                                                                                                                    |
| — Open IE communication                                                                                        | Yes                                                                                                                                                                    |
| — IRT                                                                                                          | Yes                                                                                                                                                                    |
| — MRP                                                                                                          | Yes; As MRP redundancy manager and/or MRP client; max. number of devices in the ring: 50                                                                               |
| — PROFinergy                                                                                                   | Yes                                                                                                                                                                    |
| — Prioritized startup                                                                                          | Yes; Max. 32 PROFINET devices                                                                                                                                          |
| — Number of connectable IO Devices, max.                                                                       | 256; In total, up to 768 distributed I/O devices can be connected via PROFIBUS or PROFINET                                                                             |
| — of which IO devices with IRT and "high performance" option, max.                                             | 64                                                                                                                                                                     |
| — Number of connectable IO Devices for RT, max.                                                                | 256                                                                                                                                                                    |
| — of which in line, max.                                                                                       | 256                                                                                                                                                                    |
| — Number of IO Devices that can be simultaneously activated/deactivated, max.                                  | 8                                                                                                                                                                      |
| — Number of IO Devices per tool, max.                                                                          | 8                                                                                                                                                                      |
| — Updating times                                                                                               | The minimum value of the update time also depends on communication share set for PROFINET IO, on the number of IO devices, and on the quantity of configured user data |
| <b>with RT</b>                                                                                                 |                                                                                                                                                                        |
| — for send cycle of 250 µs                                                                                     | 250 µs to 128 ms                                                                                                                                                       |
| — for send cycle of 500 µs                                                                                     | 500 µs to 256 ms                                                                                                                                                       |
| — for send cycle of 1 ms                                                                                       | 1 ms to 512 ms                                                                                                                                                         |
| — for send cycle of 2 ms                                                                                       | 2 ms to 512 ms                                                                                                                                                         |
| — for send cycle of 4 ms                                                                                       | 4 ms to 512 ms                                                                                                                                                         |
| <b>With IRT</b>                                                                                                |                                                                                                                                                                        |
| — for send cycle of 250 µs                                                                                     | 250 µs to 4 ms; Note: In the case of IRT with isochronous mode, the minimum update time of 500 µs of the isochronous OB is decisive                                    |
| — for send cycle of 500 µs                                                                                     | 500 µs to 8 ms                                                                                                                                                         |
| — for send cycle of 1 ms                                                                                       | 1 ms to 16 ms                                                                                                                                                          |
| — for send cycle of 2 ms                                                                                       | 2 ms to 32 ms                                                                                                                                                          |
| — for send cycle of 4 ms                                                                                       | 4 ms to 64 ms                                                                                                                                                          |
| — for IRT with the "high performance" option and parameter assignment for so-called "odd-numbered" send cycles | Update time = set "odd" send clock (any multiple of 125 µs: 375 µs, 625 µs ... 3 875 µs)                                                                               |

| PROFINET IO Device                                  |                                                                                            |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------|
| Services                                            |                                                                                            |
| — PG/OP communication                               | Yes                                                                                        |
| — S7 routing                                        | Yes                                                                                        |
| — Isochronous mode                                  | No                                                                                         |
| — Open IE communication                             | Yes                                                                                        |
| — IRT                                               | Yes                                                                                        |
| — MRP                                               | Yes                                                                                        |
| — PROFINergy                                        | Yes                                                                                        |
| — Shared device                                     | Yes                                                                                        |
| — Number of IO Controllers with shared device, max. | 4                                                                                          |
| SIMATIC communication                               |                                                                                            |
| • S7 communication, as server                       | Yes                                                                                        |
| • S7 communication, as client                       | Yes                                                                                        |
| • User data per job, max.                           | See online help (S7 communication, user data size)                                         |
| Open IE communication                               |                                                                                            |
| • TCP/IP                                            | Yes                                                                                        |
| — Data length, max.                                 | 64 kbyte                                                                                   |
| — several passive connections per port, supported   | Yes                                                                                        |
| • ISO-on-TCP (RFC1006)                              | Yes                                                                                        |
| — Data length, max.                                 | 64 kbyte                                                                                   |
| • UDP                                               | Yes                                                                                        |
| — Data length, max.                                 | 1 472 byte                                                                                 |
| • DHCP                                              | No                                                                                         |
| • SNMP                                              | Yes                                                                                        |
| • DCP                                               | Yes                                                                                        |
| • LLDP                                              | Yes                                                                                        |
| Web server                                          |                                                                                            |
| • HTTP                                              | Yes; Standard and user-defined pages                                                       |
| • HTTPS                                             | Yes; Standard and user-defined pages                                                       |
| PROFIBUS DP master                                  |                                                                                            |
| • Number of connections, max.                       | 48; for the integrated PROFIBUS DP interface                                               |
| Services                                            |                                                                                            |
| — PG/OP communication                               | Yes                                                                                        |
| — S7 routing                                        | Yes                                                                                        |
| — Data record routing                               | Yes                                                                                        |
| — Isochronous mode                                  | Yes                                                                                        |
| — Equidistance                                      | Yes                                                                                        |
| — Number of DP slaves                               | 125; In total, up to 768 distributed I/O devices can be connected via PROFIBUS or PROFINET |

|                                                                 |                                                                      |
|-----------------------------------------------------------------|----------------------------------------------------------------------|
| — Activation/deactivation of DP slaves                          | Yes                                                                  |
| <b>Further protocols</b>                                        |                                                                      |
| • MODBUS                                                        | Yes; MODBUS TCP                                                      |
| <b>Media redundancy</b>                                         |                                                                      |
| • Switchover time on line break, typ.                           | 200 ms                                                               |
| • Number of stations in the ring, max.                          | 50                                                                   |
| <b>Isochronous mode</b>                                         |                                                                      |
| Isochronous operation (application synchronized up to terminal) | Yes; With minimum OB 6x cycle of 375 µs                              |
| Equidistance                                                    | Yes                                                                  |
| <b>S7 message functions</b>                                     |                                                                      |
| Number of login stations for message functions, max.            | 32                                                                   |
| Block related messages                                          | Yes                                                                  |
| Number of configurable alarms, max.                             | 10 000                                                               |
| Number of simultaneously active alarms in alarm pool            |                                                                      |
| • Number of reserved user alarms                                | 600                                                                  |
| • Number of reserved alarms for system diagnostics              | 200                                                                  |
| • Number of reserved alarms for motion technology objects       | 160                                                                  |
| <b>Test commissioning functions</b>                             |                                                                      |
| Joint commission (Team Engineering)                             | Yes; Parallel online access possible for up to 8 engineering systems |
| Status block                                                    | Yes; Up to 8 simultaneously (in total across all ES clients)         |
| Single step                                                     | No                                                                   |
| <b>Status/control</b>                                           |                                                                      |
| • Status/control variable                                       | Yes                                                                  |
| • Variables                                                     | Inputs/outputs, memory bits, DBs, distributed I/Os, timers, counters |
| • Number of variables, max.                                     |                                                                      |
| — of which status variables, max.                               | 200; per job                                                         |
| — of which control variables, max.                              | 200; per job                                                         |
| <b>Forcing</b>                                                  |                                                                      |
| • Forcing, variables                                            | Peripheral inputs/outputs                                            |
| • Number of variables, max.                                     | 200                                                                  |
| <b>Diagnostic buffer</b>                                        |                                                                      |
| • present                                                       | Yes                                                                  |
| • Number of entries, max.                                       | 3 200                                                                |
| — of which powerfail-proof                                      | 500                                                                  |
| <b>Traces</b>                                                   |                                                                      |
| • Number of configurable Traces                                 | 4; Up to 512 KB of data per trace are possible                       |

## Interrupts/diagnostics/status information

### Diagnostics indication LED

|                                 |     |
|---------------------------------|-----|
| • RUN/STOP LED                  | Yes |
| • ERROR LED                     | Yes |
| • MAINT LED                     | Yes |
| • Connection display LINK TX/RX | Yes |

## supported technology objects

### Motion

|                                                                               |                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| • Speed-controlled axis<br>— Number of speed-controlled axes, max.            | Yes<br><br>30; Requirement: There must be no other motion technology objects created; note: The number of axes affects the cycle time of the PLC program; selection guide via the TIA Selection Tool |
| • Positioning axis<br>— Number of positioning axes, max.                      | 30; Requirement: There must be no other motion technology objects created; note: The number of axes affects the cycle time of the PLC program; selection guide via the TIA Selection Tool            |
| • Synchronized axes (relative gear synchronization)<br>— Number of axes, max. | 15; Requirement: There must be no other motion technology objects created; note: The number of axes affects the cycle time of the PLC program; selection guide via the TIA Selection Tool            |
| • External encoders<br>— Number of external encoders, max.                    | 30; Requirement: There must be no other motion technology objects created; note: The number of axes affects the cycle time of the PLC program; selection guide via the TIA Selection Tool            |

### Controller

|               |                                                                  |
|---------------|------------------------------------------------------------------|
| • PID_Compact | Yes; Universal PID controller with integrated optimization       |
| • PID_3Step   | Yes; PID controller with integrated optimization for valves      |
| • PID-Temp    | Yes; PID controller with integrated optimization for temperature |

### Counting and measuring

|                      |     |
|----------------------|-----|
| • High-speed counter | Yes |
|----------------------|-----|

## Ambient conditions

### Ambient temperature during operation

|                                 |                                                                                                    |
|---------------------------------|----------------------------------------------------------------------------------------------------|
| • horizontal installation, min. | 0 °C                                                                                               |
| • horizontal installation, max. | 60 °C; Display: 50 °C, at an operating temperature of typically 50 °C, the display is switched off |
| • vertical installation, min.   | 0 °C                                                                                               |
| • vertical installation, max.   | 40 °C; Display: 40 °C, at an operating temperature of typically 40 °C, the display is switched off |

## Configuration

### Programming

#### Programming language

|       |     |
|-------|-----|
| — LAD | Yes |
|-------|-----|

|                                           |                               |
|-------------------------------------------|-------------------------------|
| — FBD                                     | Yes                           |
| — STL                                     | Yes                           |
| — SCL                                     | Yes                           |
| — GRAPH                                   | Yes                           |
| Know-how protection                       |                               |
| • User program protection                 | Yes                           |
| • Copy protection                         | Yes                           |
| • Block protection                        | Yes                           |
| Access protection                         |                               |
| • Password for display                    | Yes                           |
| • Protection level: Write protection      | Yes                           |
| • Protection level: Read/write protection | Yes                           |
| • Protection level: Complete protection   | Yes                           |
| Cycle time monitoring                     |                               |
| • lower limit                             | adjustable minimum cycle time |
| • upper limit                             | adjustable maximum cycle time |
| Dimensions                                |                               |
| Width                                     | 70 mm                         |
| Height                                    | 147 mm                        |
| Depth                                     | 129 mm                        |
| Weights                                   |                               |
| Weight, approx.                           | 845 g                         |
| <b>last modified:</b>                     | 31.08.2015                    |