

SIMATIC S7-400, CPU 412-2 PN Central processing unit with: Work memory 1 MB, (0.5 MB code; 0.5 MB data) interfaces 1st interface MPI/DP 12 Mbit/s, (X1), 2nd interface Ethernet/PROFINET (X5)



General information	
Product type designation	CPU 412-2 PN
HW functional status	01
Firmware version	V7.0
Engineering with	
<ul style="list-style-type: none"> <li>Programming package</li> </ul>	STEP 7 V5.5 or higher with HSP 262
CiR – Configuration in RUN	
CiR synchronization time, basic load	100 ms
CiR synchronization time, time per I/O byte	30 $\mu$ s
Supply voltage	
Rated value (DC)	
<ul style="list-style-type: none"> <li>24 V DC</li> </ul>	No; Power supply via system power supply
Input current	
from backplane bus 5 V DC, typ.	1.1 A
from backplane bus 5 V DC, max.	1.4 A
from backplane bus 24 V DC, max.	150 mA; 150 mA per DP interface
from interface 5 V DC, max.	90 mA; At the DP interface

Power loss	
Power loss, typ.	5.5 W
Power loss, max.	7 W

## Memory

Type of memory	RAM
Work memory	
<ul style="list-style-type: none"> <li>integrated</li> </ul>	1 Mbyte
<ul style="list-style-type: none"> <li>integrated (for program)</li> </ul>	512 kbyte
<ul style="list-style-type: none"> <li>integrated (for data)</li> </ul>	512 kbyte
<ul style="list-style-type: none"> <li>expandable</li> </ul>	No
Load memory	
<ul style="list-style-type: none"> <li>expandable FEPRM</li> </ul>	Yes; with Memory Card (FLASH)
<ul style="list-style-type: none"> <li>expandable FEPRM, max.</li> </ul>	64 Mbyte
<ul style="list-style-type: none"> <li>integrated RAM, max.</li> </ul>	512 kbyte
<ul style="list-style-type: none"> <li>expandable RAM</li> </ul>	Yes; with Memory Card (RAM)
<ul style="list-style-type: none"> <li>expandable RAM, max.</li> </ul>	64 Mbyte
Backup	
<ul style="list-style-type: none"> <li>present</li> </ul>	Yes
<ul style="list-style-type: none"> <li>with battery</li> </ul>	Yes; all data
<ul style="list-style-type: none"> <li>without battery</li> </ul>	No

## Battery

Backup battery	
<ul style="list-style-type: none"> <li>Backup current, typ.</li> </ul>	180 $\mu$ A; up to 40 °C
<ul style="list-style-type: none"> <li>Backup current, max.</li> </ul>	850 $\mu$ A
<ul style="list-style-type: none"> <li>Backup time, max.</li> </ul>	Dealt with in the module data manual with the secondary conditions and the factors of influence
<ul style="list-style-type: none"> <li>Feeding of external backup voltage to CPU</li> </ul>	5 V DC to 15 V DC

## CPU processing times

for bit operations, typ.	31.25 ns
for word operations, typ.	31.25 ns
for fixed point arithmetic, typ.	31.25 ns
for floating point arithmetic, typ.	62.5 ns

## CPU-blocks

DB	
<ul style="list-style-type: none"> <li>Number, max.</li> </ul>	3 000; Number range: 1 to 16000
<ul style="list-style-type: none"> <li>Size, max.</li> </ul>	64 kbyte
FB	
<ul style="list-style-type: none"> <li>Number, max.</li> </ul>	1 500; Number range: 0 to 7999
<ul style="list-style-type: none"> <li>Size, max.</li> </ul>	64 kbyte
FC	
<ul style="list-style-type: none"> <li>Number, max.</li> </ul>	1 500; Number range: 0 to 7999

• Size, max.	64 kbyte
<b>OB</b>	
• Number, max.	see instruction list
• Size, max.	64 kbyte
• Number of free cycle OBs	1; OB 1
• Number of time alarm OBs	2; OB 10, 11
• Number of delay alarm OBs	2; OB 20, 21
• Number of cyclic interrupt OBs	2; OB 32, 35 (shortest cycle that can be set = 500 µs)
• Number of process alarm OBs	2; OB 40, 41
• Number of DPV1 alarm OBs	3; OB 55-57
• Number of isochronous mode OBs	2; OB 61-62
• Number of multicomputing OBs	1; OB 60
• Number of background OBs	1; OB 90
• Number of startup OBs	3; OB 100-102
• Number of asynchronous error OBs	9; OB 80-88
• Number of synchronous error OBs	2; OB 121, 122
<b>Nesting depth</b>	
• per priority class	24
• additional within an error OB	1
<b>Counters, timers and their retentivity</b>	
<b>S7 counter</b>	
• Number	2 048
<b>Retentivity</b>	
— adjustable	Yes
— lower limit	0
— upper limit	2 047
— preset	Z 0 to Z 7
<b>Counting range</b>	
— lower limit	0
— upper limit	999
<b>IEC counter</b>	
• present	Yes
• Type	SFB
• Number	Unlimited (limited only by RAM capacity)
<b>S7 times</b>	
• Number	2 048
<b>Retentivity</b>	
— adjustable	Yes
— lower limit	0
— upper limit	2 047
— preset	No times retentive

<b>Time range</b>	
— lower limit	10 ms
— upper limit	9 990 s
<b>IEC timer</b>	
• present	Yes
• Type	SFB
• Number	Unlimited (limited only by RAM capacity)
<b>Data areas and their retentivity</b>	
retentive data area in total	Total working and load memory (with backup battery)
<b>Flag</b>	
• Number, max.	4 kbyte; Size of bit memory address area
• Retentivity available	Yes
• Retentivity preset	MB 0 to MB 15
• Number of clock memories	8; in 1 memory byte
<b>Local data</b>	
• adjustable, max.	8 kbyte
• preset	4 kbyte
<b>Address area</b>	
<b>I/O address area</b>	
• Inputs	4 kbyte
• Outputs	4 kbyte
<b>of which distributed</b>	
— MPI/DP interface, inputs	2 kbyte
— MPI/DP interface, outputs	2 kbyte
— PROFINET interface, inputs	4 kbyte
— PROFINET interface, outputs	4 kbyte
<b>Process image</b>	
• Inputs, adjustable	4 kbyte
• Outputs, adjustable	4 kbyte
• Inputs, default	128 byte
• Outputs, default	128 byte
• consistent data, max.	244 byte
• Access to consistent data in process image	Yes
<b>Subprocess images</b>	
• Number of subprocess images, max.	15
<b>Digital channels</b>	
• Inputs	32 768
— of which central	32 768
• Outputs	32 768
— of which central	32 768
<b>Analog channels</b>	

• Inputs	2 048
— of which central	2 048
• Outputs	2 048
— of which central	2 048

### Hardware configuration

Number of expansion units, max.	21
connectable OPs	47
Multicomputing	Yes; 4 CPUs max. (with UR1 or UR2)

### Interface modules

• Number of connectable IMs (total), max.	6
• Number of connectable IM 460s, max.	6
• Number of connectable IM 463s, max.	4; IM 463-2

### Number of DP masters

• integrated	1
• via CP	10; CP 443-5 Extended
• via IM 467	4
• Mixed mode IM + CP permitted	No; IM 467 cannot be used jointly with CP 443-5 Ext. or CP 443-1 in PROFINET IO mode
• via interface module	0
• Number of pluggable S5 modules (via adapter capsule in central device), max.	6

### Number of IO Controllers

• integrated	1
• via CP	4; Max. 4 in the central controller; no mixed operation of different CP 443-1 types in PROFINET IO mode

### Number of operable FMs and CPs (recommended)

• FM	Limited by number of slots and number of connections
• CP, PtP	CP 440: Limited by number of slots; CP 441: Limited by number of slots and number of connections
• PROFIBUS and Ethernet CPs	14; In total max. 10 CPs as DP master and PROFINET controller, of which up to 10 IMs or CPs as DP master and up to 4 CPs as PROFINET controller

### Slots

• required slots	1
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### Time of day

#### Clock

• Hardware clock (real-time)	Yes
• retentive and synchronizable	Yes
• Resolution	1 ms
• Deviation per day (buffered), max.	1.7 s; Power off
• Deviation per day (unbuffered), max.	8.6 s; For power On

#### Operating hours counter

• Number	16
• Number/Number range	0 to 15
• Range of values	SFCs 2, 3 and 4: 0 to 32767 hours SFC 101: 0 to 2 <sup>31</sup> - 1 hours
• Granularity	1 h
• retentive	Yes

#### Clock synchronization

• supported	Yes
• to MPI, master	Yes
• to MPI, slave	Yes
• to DP, master	Yes
• to DP, slave	Yes
• in AS, master	Yes
• in AS, slave	Yes
• on Ethernet via NTP	Yes; As client
• to IF 964 DP	No

#### Time difference in system when synchronizing via

• Ethernet, max.	10 ms
• MPI, max.	200 ms

#### Interfaces

Interfaces/bus type	1 x MPI/PROFIBUS DP, 1 x PROFINET (2 ports)
Number of RS 485 interfaces	1; Combined MPI / PROFIBUS DP

#### 1. Interface

Interface type	Integrated
Physics	RS 485 / PROFIBUS + MPI
Isolated	Yes
Power supply to interface (15 to 30 V DC), max.	150 mA
Number of connection resources	MPI: 32, DP: 16

#### Protocols

• MPI	Yes
• PROFIBUS DP master	Yes
• PROFIBUS DP slave	Yes

#### MPI

• Number of connections	32; If a diagnostics repeater is used on the line, the number of connection resources on the line is reduced by 1
• Transmission rate, max.	12 Mbit/s

#### Services

— PG/OP communication	Yes
— Routing	Yes
— Global data communication	Yes
— S7 basic communication	Yes
— S7 communication	Yes

— S7 communication, as client	Yes
— S7 communication, as server	Yes
<b>PROFIBUS DP master</b>	
• Number of connections, max.	16; If a diagnostics repeater is used on the line, the number of connection resources on the line is reduced by 1
• Transmission rate, max.	12 Mbit/s
• Number of DP slaves, max.	32
<b>Services</b>	
— PG/OP communication	Yes
— Routing	Yes; S7 routing
— Global data communication	No
— S7 basic communication	Yes
— S7 communication	Yes
— S7 communication, as client	Yes
— S7 communication, as server	Yes
— Equidistance	Yes
— Isochronous mode	Yes
— SYNC/FREEZE	Yes
— Activation/deactivation of DP slaves	Yes
— Direct data exchange (slave-to-slave communication)	Yes
— DPV1	Yes
<b>Address area</b>	
— Inputs, max.	2 kbyte
— Outputs, max.	2 kbyte
<b>User data per DP slave</b>	
— User data per DP slave, max.	244 byte
— Inputs, max.	244 byte
— Outputs, max.	244 byte
— Slots, max.	244
— per slot, max.	128 byte
<b>PROFIBUS DP slave</b>	
• Number of connections	16
• GSD file	<a href="http://support.automation.siemens.com/WW/view/en/113652">http://support.automation.siemens.com/WW/view/en/113652</a>
• Transmission rate, max.	12 Mbit/s
• automatic baud rate search	No
• Address area, max.	32; Virtual slots
• User data per address area, max.	32 byte
— of which consistent, max.	32 byte
<b>Services</b>	
— PG/OP communication	Yes; with interface active
— S7 routing	Yes; with interface active

— Global data communication	No
— S7 basic communication	No
— S7 communication	Yes
— S7 communication, as client	Yes
— S7 communication, as server	Yes
— Direct data exchange (slave-to-slave communication)	No
— DPV1	No
<b>Transfer memory</b>	
— Inputs	244 byte
— Outputs	244 byte

## 2. Interface

Interface type	PROFINET
Physics	Ethernet RJ45
Isolated	Yes
automatic detection of transmission rate	Yes; Autosensing
Autonegotiation	Yes
Autocrossing	Yes
Change of IP address at runtime, supported	Yes; Assignment by higher-level IO-Controller or by the user program with SFB104 "IP_CONF"
Number of connection resources	48

<b>Interface types</b>	
• Number of ports	2
• integrated switch	Yes

<b>Media redundancy</b>	
• supported	Yes
• Switchover time on line break, typ.	200 ms
• Number of stations in the ring, max.	50

<b>Protocols</b>	
• PROFINET IO Controller	Yes
• PROFINET IO Device	Yes
• PROFINET CBA	Yes
• PROFIBUS DP master	No
• PROFIBUS DP slave	No
• Open IE communication	Yes
• Web server	Yes
• Point-to-point connection	No

<b>PROFINET IO Controller</b>	
• Transmission rate, max.	100 Mbit/s

<b>Services</b>	
— PG/OP communication	Yes
— S7 routing	Yes



— S7 communication	Yes
— Isochronous mode	Yes; Only with IRT and the High Performance option
— Open IE communication	Yes
— Shared device	Yes
— Prioritized startup	Yes
— Number of IO devices with prioritized startup, max.	32
— Number of connectable IO Devices, max.	256
— Of which IO devices with IRT, max.	64
— of which in line, max.	64
— Number of IO Devices with IRT and the option "high flexibility"	256
— of which in line, max.	61
— Number of connectable IO Devices for RT, max.	256
— of which in line, max.	256
— Activation/deactivation of IO Devices	Yes
— Number of IO Devices that can be simultaneously activated/deactivated, max.	8
— IO Devices changing during operation (partner ports), supported	Yes
— Number of IO Devices per tool, max.	8; 8 parallel calls of the SFC 12 "D_ACT_DP" possible per line. Max. 32 IO Devices changing during operation (partner ports) are supported
— Device replacement without swap medium	Yes
— Send cycles	250 µs, 500 µs, 1 ms, 2 ms, 4 ms additionally with IRT with high performance: 250 µs to 4 ms in 125 µs frame
— Updating time	250 µs to 512 ms; minimum value depends on preset communication share for PROFINET IO, on the number of IO Devices and on the amount of configured user data, see PROFINET system description

#### Address area

— Inputs, max.	4 kbyte
— Outputs, max.	4 kbyte
— User data consistency, max.	1 024 byte

#### PROFINET IO Device

##### Services

— PG/OP communication	Yes
— S7 routing	Yes
— S7 communication	Yes
— Isochronous mode	No
— Open IE communication	Yes
— IRT	Yes

— Prioritized startup	Yes
— Shared device	Yes
— Number of IO Controllers with shared device, max.	2
<b>Transfer memory</b>	
— Inputs, max.	1 440 byte; Per IO Controller with shared device
— Outputs, max.	1 440 byte; Per IO Controller with shared device
<b>Submodules</b>	
— Number, max.	64
— User data per submodule, max.	1 024 byte
<b>PROFINET CBA</b>	
• acyclic transmission	Yes
• cyclic transmission	Yes
<b>Open IE communication</b>	
• Number of connections, max.	46
• Local port numbers used at the system end	0, 20, 21, 25, 80, 102, 135, 161, 34962, 34963, 34964, 65532, 65533, 65534, 65535
• Keep-alive function, supported	Yes
<b>Protocols</b>	
<b>Open IE communication</b>	
• TCP/IP	Yes; via integrated PROFINET interface and loadable FBs
— Number of connections, max.	46
— Data length, max.	32 kbyte
— several passive connections per port, supported	Yes
• ISO-on-TCP (RFC1006)	Yes; Via integrated PROFINET interface or CP 443-1 Adv. and loadable FBs
— Number of connections, max.	46
— Data length, max.	32 kbyte; 1452 bytes via CP 443-1 Adv.
• UDP	Yes; via integrated PROFINET interface and loadable FBs
— Number of connections, max.	46
— Data length, max.	1 472 byte
<b>Web server</b>	
• supported	Yes
• User-defined websites	Yes
• Number of HTTP clients	5
<b>Isochronous mode</b>	
Isochronous operation (application synchronized up to terminal)	Yes; Via PROFIBUS DP or PROFINET interface
Equidistance	Yes
Number of DP masters with isochronous mode	1
User data per isochronous slave, max.	244 byte

shortest clock pulse	1.5 ms; 0.5 ms without use of SFC 126, 127
max. cycle	32 ms
<b>Communication functions</b>	
PG/OP communication	Yes
<ul style="list-style-type: none"> <li>• Number of connectable OPs without message processing</li> </ul>	47
<ul style="list-style-type: none"> <li>• Number of connectable OPs with message processing</li> </ul>	47; When using Alarm_S/SQ and Alarm_D/DQ
Data record routing	Yes
<b>Global data communication</b>	
<ul style="list-style-type: none"> <li>• supported</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• Number of GD loops, max.</li> </ul>	8
<ul style="list-style-type: none"> <li>• Number of GD packets, transmitter, max.</li> </ul>	8
<ul style="list-style-type: none"> <li>• Number of GD packets, receiver, max.</li> </ul>	16
<ul style="list-style-type: none"> <li>• Size of GD packets, max.</li> </ul>	54 byte
<ul style="list-style-type: none"> <li>• Size of GD packet (of which consistent), max.</li> </ul>	1 variable
<b>S7 basic communication</b>	
<ul style="list-style-type: none"> <li>• supported</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• User data per job, max.</li> </ul>	76 byte
<ul style="list-style-type: none"> <li>• User data per job (of which consistent), max.</li> </ul>	1 variable
<b>S7 communication</b>	
<ul style="list-style-type: none"> <li>• supported</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• as server</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• as client</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• User data per job, max.</li> </ul>	64 kbyte
<ul style="list-style-type: none"> <li>• User data per job (of which consistent), max.</li> </ul>	462 byte; 1 variable
<b>S5 compatible communication</b>	
<ul style="list-style-type: none"> <li>• supported</li> </ul>	Yes; Via FC AG_SEND and AG_RECV, max. via 10 CP 443-1 or 443-5
<ul style="list-style-type: none"> <li>• User data per job, max.</li> </ul>	8 kbyte
<ul style="list-style-type: none"> <li>• User data per job (of which consistent), max.</li> </ul>	240 byte
<ul style="list-style-type: none"> <li>• Number of simultaneous AG-SEND/AG-RECV orders per CPU, max.</li> </ul>	24/24
<b>Standard communication (FMS)</b>	
<ul style="list-style-type: none"> <li>• supported</li> </ul>	Yes; Via CP and loadable FB
<b>PROFINET CBA (at set setpoint communication load)</b>	
<ul style="list-style-type: none"> <li>• Setpoint for the CPU communication load</li> </ul>	20 %
<ul style="list-style-type: none"> <li>• Number of remote interconnection partners</li> </ul>	32
<ul style="list-style-type: none"> <li>• Number of functions, master/slave</li> </ul>	150
<ul style="list-style-type: none"> <li>• Total of all master/slave connections</li> </ul>	4 500
<ul style="list-style-type: none"> <li>• Data length of all incoming connections master/slave, max.</li> </ul>	45 000 byte

• Data length of all outgoing connections master/slave, max.	45 000 byte
• Number of device-internal and PROFIBUS interconnections	1 000
• Data length of device-internal und PROFIBUS interconnections, max.	16 000 byte
• Data length per connection, max.	2 000 byte
<b>Remote interconnections with acyclic transmission</b>	
— Sampling frequency: Sampling time, min.	200 ms; Depending on preset communication load, number of interconnections and data length used
— Number of incoming interconnections	250
— Number of outgoing interconnections	250
— Data length of all incoming interconnections, max.	8 000 byte
— Data length of all outgoing interconnections, max.	8 000 byte
— Data length per connection, max.	2 000 byte
<b>Remote interconnections with cyclic transmission</b>	
— Transmission frequency: Transmission interval, min.	1 ms; Depending on preset communication load, number of interconnections and data length used
— Number of incoming interconnections	300
— Number of outgoing interconnections	300
— Data length of all incoming interconnections, max.	4 800 byte
— Data length of all outgoing interconnections, max.	4 800 byte
— Data length per connection, max.	450 byte
<b>HMI variables via PROFINET (acyclic)</b>	
— Number of stations that can log on for HMI variables (PN OPC/iMap)	2x PN OPC/1x iMap
— HMI variable updating	500 ms
— Number of HMI variables	1 000
— Data length of all HMI variables, max.	32 000 byte
<b>PROFIBUS proxy functionality</b>	
— supported	Yes; 32 PROFIBUS slaves max. connectable
— Data length per connection, max.	240 byte; Slave-dependent
<b>Number of connections</b>	
• overall	48
• usable for PG communication	47
— reserved for PG communication	1
— adjustable for PG communication, max.	0
• usable for OP communication	47
— reserved for OP communication	1

— adjustable for OP communication, max.	0
• usable for S7 basic communication	46
— reserved for S7 basic communication	0
— adjustable for S7 basic communication, max.	0
• usable for S7 communication	46
— reserved for S7 communication	0
— adjustable for S7 communication, max.	0
• usable for routing	23
— reserved for routing	0
— adjustable for routing, max.	0

### S7 message functions

Number of login stations for message functions, max.	47; Max. 47 with Alarm_S/SQ and Alarm_D/DQ (OPs); max. 8 with Alarm, Alarm_8, Alarm_8P, Notify and Notify_8 (e.g. WinCC)
Symbol-related messages	Yes
SCAN procedure	Yes
Program alarms	Yes
Process diagnostic messages	Yes
simultaneously active Alarm-S blocks, max.	250; Simultaneously active alarm_S/SQ blocks or alarm_D/DQ blocks
Alarm 8-blocks	Yes
• Number of instances for alarm 8 and S7 communication blocks, max.	300
• preset, max.	150
Process control messages	Yes
Number of archives that can log on simultaneously (SFB 37 AR_SEND)	4
<b>Number of messages</b>	
• overall, max.	256
• in 100 ms grid, max.	0
• in 500 ms grid, max.	256
• in 1000 ms grid, max.	256
<b>Number of additional values</b>	
• with 100 ms grid, max.	0
• with 500, 1000 ms grid, max.	1

### Test commissioning functions

Status block	Yes; Up to 16 simultaneously
Single step	Yes
Number of breakpoints	16
<b>Status/control</b>	
• Status/control variable	Yes; Up to 16 variable tables

• Variables	Inputs/outputs, memory bits, DBs, distributed I/Os, timers, counters
• Number of variables, max.	70; Status/control
<b>Forcing</b>	
• Forcing	Yes
• Forcing, variables	Inputs/outputs, bit memories, distributed I/Os
• Number of variables, max.	64
<b>Diagnostic buffer</b>	
• present	Yes
• Number of entries, max.	3 200
— adjustable	Yes
— preset	120
<b>Service data</b>	
• can be read out	Yes
<b>Standards, approvals, certificates</b>	
CE mark	Yes
CSA approval	Yes
UL approval	Yes
cULus	Yes
FM approval	Yes
RCM (formerly C-TICK)	Yes
KC approval	Yes
EAC (formerly Gost-R)	Yes
<b>Use in hazardous areas</b>	
• ATEX	ATEX II 3G Ex nA IIC T4 Gc
<b>Ambient conditions</b>	
<b>Ambient temperature during operation</b>	
• min.	0 °C
• max.	60 °C
<b>Configuration</b>	
<b>Configuration software</b>	
• STEP 7	Yes
<b>Programming</b>	
• Command set	see instruction list
• Nesting levels	7
• Access to consistent data in process image	Yes
• System functions (SFC)	see instruction list
• System function blocks (SFB)	see instruction list
<b>Programming language</b>	
— LAD	Yes
— FBD	Yes

— STL	Yes
— SCL	Yes
— CFC	Yes
— GRAPH	Yes
— HiGraph®	Yes
<b>Number of simultaneously active SFCs</b>	
— DPSYC_FR	2; SFC 11; per interface
— D_ACT_DP	8; SFC 12; per interface
— RD_REC	8; SFC 59; per interface
— WR_REC	8; SFC 58; per interface
— WR_PARM	8; SFC 55; per interface
— PARM_MOD	1; SFC 57; per interface
— WR_DPARM	2; SFC 56; per interface
— DPNRM_DG	8; SFC 13; per interface
— RDSYSST	8; SFC 51
— DP_TOPOL	1; SFC 103; per interface
<b>Number of simultaneously active SFBs</b>	
— RDREC	8; SFB 52; per interface, but not more than 32 across all external interfaces
— WRREC	8; SFB 53; per interface, but not more than 32 across all external interfaces
<b>Know-how protection</b>	
• User program protection/password protection	Yes
• Block encryption	Yes; With S7 block Privacy
<b>Dimensions</b>	
Width	25 mm
Height	290 mm
Depth	219 mm
<b>Weights</b>	
Weight, approx.	750 g
<b>last modified:</b>	07/16/2018