AMTEC.PRO
Automating Your Production

Oprema za avtomatizacijo

Splošne specifikacije

Factory Automation Equipment

General Specification

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01 SPLOŠNE ZAHTEVE / SPECIFIKACIJE ZA NAPRAVE

Naprava je zmožna delovati neprekinjeno brez prekinitev. Obraba sme nastati samo na delih, ki so izmenljivi in so identificirani na spisku obrabnih/rezervnih delov.

Naprava je zasnovana s skrbjo za okolje in morebitne dolgoročne učinke, pri čemer je upoštevano:

- Minimalna poraba energije,
- Nivo hrupa pod 75dB,
- Uporaba okolju prijaznih materialov
- Nastajanje odpadkov, prahu, aerosolov, itd.,
- Razgradnja na koncu življenjske dobe
- Kakršen koli drug vpliv naprave na okolje.

1.1 CE OZNAKA IN STANDARDI

Naprava je skladna z ustreznimi direktivami evropske unije in harmoniziranimi standardi. Tehnična mapa naprave je dosegljiva pri proizvajalcu, naprava je opremljena s CE napisno ploščico ter odpremljena z izdanim certifikatom o skladnosti.

Naslednji harmonizirani standardi so upoštevani pri ustvarjanju domneve o skladnosti s CE predpisi tokom izdelave ocene tveganja, načrtovanja, sestave in testiranja:

Standard	Opis
EN 1037:1995+A1:2008	Safety of machinery - Prevention of unexpected start-up
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1:2015	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015)
EN ISO 13849-2:2012	Safety of machinery - Safety-related parts of control systems - Part 2: Validation (ISO 13849-2:2012)
EN ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design (ISO 13850:2015)
EN ISO 13855:2010	Safety of machinery - Positioning of safeguards with respect to the approach speeds of parts of the human body (ISO 13855:2010)
EN ISO 14120:2015	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards (ISO 14120:2015)
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN 60204-1:2006/A1:2009	Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2005/A1:2008)
EN 61439-1:2011	Low-voltage switchgear and controlgear assemblies - Part 1: General rules (IEC 61439-1:2011)
TR 14121-2:2012	Safety of machinery -- Risk assessment - Part 2: Practical guidance and examples of methods
EN ISO 10218-1:2011	Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots
IEC 61800-5-2-2007	Adjustable speed electrical power drive systems -- Part 5-2: Safety requirements - Functional
EN ISO 13732-1:2008	Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces (ISO 13732-1:2006)
EN 349:1993+A1:2008	Safety of machinery - Minimum gaps to avoid crushing of parts of the human body
EN 60445:2017	Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors
EN 61293:1994	Marking of electrical equipment with ratings related to electrical supply - Safety requirements

1.2 VARNOST

Naprava je zasnovana tako, da je varna pred napakami, kar pomeni, da so bili vsi postopki med načrtovanjem ocenjeni za najbolj preprosto varnost pri pregledih načrtovanja. Oprema je zasnovana za uporabo usposobljenega osebja v naslednjih načinih:

Način delovanja	Varnostne zahteve	Upravljalec
Avtomatsko delovanje	Fail-safe	Operater
Koračno delovanje	Fail-safe	Operater
Ročno delovanje	Fail-safe	Operater
Prenastavljanje/zagon	Fail-safe	Operater
Kalibracija	Izvaja le pooblaščena oseba	Tehnik
Čiščenje	Naprave je zaustavljena	Operater
Vzdrževanje	Izvaja le pooblaščena oseba	Tehnik

1.3 PRINCIPI NAČRTOVANJA

Naprava je izdelana iz težke toge osnove iz aluminijastih profilov. Če statična obremenitev, dinamična obremenitev ali vibracije presegajo stabilnost konstrukcije, se uporabi varjena jeklena osnovna konstrukcija. Lahki aluminijasti profili se uporabljajo za varnostne ograje in podobne obodne gradnike.

Mehanska osnovna konstrukcija je osnova naprave. Vse površine, vključene v funkcionalnost, so ravne, pravokotne in / ali vzporedne. Vse osi za linearno vodenje ali vrtenje so zasnovane tako, da se lahko menjava motorja izvede brez ponovnega nastavljanja osi.

Načelo Poka Yoke se uporablja za vse izmenljive formatne dele.

1.3.1 POVRŠINSKA OBDELAVA IN BARVE

Vse aluminijaste površine so eloksirane. Vse jeklene površine so barvane ali brunirane.

Barvane površine so v svetlo sivi izvedbi RAL 7035. Maksimalno 20% vidnih površin je druge barve.

1.3.2 VELIKOST NAPRAVE

Maksimalna velikost naprave ki se ne da razstaviti na manjše enote je 1.800 x 1.300 x 2.100 [mm].

1.3.3 KOMPONENTE

Naprava je opremljena z izdelki naslednjih proizvajalcev:

Izdelek	Izbrani proizvajalec	Nadomestni proizvajalec
Pnevmatika	Festo	SMC
Aluminijasti profili	Minitec	Bosch-Rexroth
Električne omarice	Made to measure	Schrack
Varovalke	Schrack	ETI
Sponke	Weidmueller	
Releji / kontaktorji	Schrack	
Varovala	Sick	
PLK	Siemens	Beckhoff
Servo pogoni	Festo	
HMI	PC based	Beckhoff
Tipke	Schneider	
Senzorji	Sick	Keyence
Strojni vid	Epson	Cognex
Slikovni senzorji	Sick	Cognex, Keyence
Robot	Epson	Yaskawa
Signalni stolp	Sirena (LED)	Balluff
Komunikacijski protokol	Profinet	Modbus
I4.0	OPC UA	

1.3.4 ELEKTRO

Kontrolne komponente so uporabljene le za njihovo predvideno uporabo, vsakršno odstopanje mora biti pisno potrjeno iz strani dobavitelja. Nadzorne plošče, krmilne omare in namestitev komponent na napravo se izvaja v skladu z veljavnimi predpisi in na tak način, da kabli med predvidenim gibanjem niso nepotrebno obremenjeni in podvrženi obrabi; vsi sestavni deli, vodniki in priključki so označeni na napravi in v priloženih shemah.

Oprema lahko deluje na napetosti 1x230VAC (50Hz) ali 3x400VAC (50Hz).

BARVE VODNIKOV

Barve vodnikov za sekundarno ožičenje (po primarnem odklopniku) so izvedene v skladu z EN-60204-2 $ 14.2.4:

Barva	Opis
rumena/zelena	ozemljitev
črna	izmenična napetost ("L" in "N")
rdeča	izmenična kontrolna napetost "L"
svetlo modra	izmenična kontrolna napetost "N"
modra	enosmerna napetost "+"
modra / bela	enosmerna napetost "-"
oranžna	vodniki iz zunanjega napajanja, pod napetostjo ob izklopu glavnega stikala
vijolična	PLC vhod (do priključnih sponk)
siva	PLC izhod (do priključnih sponk)
roza	varnostni vhodi / izhodi

Vgrajena je 230VAC (6A varovalka) vtičnica za servis, kakor tudi USB in TCP/IP priključek.

Kontrolna omarica s krmilnikom je opremljena z mapo za elektro shemo.

Ob pred-prevzemu je lahko osnovna plošča krmilne omarice zapolnjena do 75%; 25% prostih DIN letev je predvidenih. 15% prostih vhodov/izhodov je predvidenih, vendar ne vgrajenih.

Osnovna kontrolna napetost je 24VDC za vse vhode in izhode krmilnika ter oddaljene vhodno izhodne terminale.

Senzorji z vtikačem se uporabljajo za hitro in enostavno menjavo.

Senzorji in stikala so 24VDC PNP, analogno 4-20mA.

STIKALNI GUMBI

Vsak stikalni gumb je opremljen z napisom. Če je potrebno, je opremljen tudi z lučko ki prikazuje stanje.

Barva	Opis
bela	vklop
črna	izklop
modra	reset
rdeča	stop
rumena	
zelena	start

SIGNALNI STOLP

Vsaka naprava ali postroj je opremljena z svetlobnim stolpom, pritrjenim na ogrodje. Signalni stolp vsebuje vsaj rdečo in zeleno barvo. Ostale barve, kakor tudi dodatni svetlobni stolpi so vgrajeni po potrebi. Za svetilke je uporabljena LED tehnologija. Hupa je dodana če mora biti operater zvočno opozorjen na spremembe delovanja.

Barva		Prikaz	Pomen
	rdeča	stalno	napaka
		utripajoče	ni uporabljeno
	rumena	stalno	opozorilo
		utripajoče	opozorilo
	modra	stalno	minimalni nivo materiala
		utripajoče	blizu konca cikla / konec cikla
	zelena	stalno	v delovanju
		utripajoče	v pripravljenosti
	bela	stalno	preostalo kar ne spada zgoraj
		utripajoče	ni uporabljeno

1.3.5 PNEVMATIKA

Pnevmatika se uporablja v primerih, ko je predraga ali nesmiselna uporaba električnega servo pogona. Pnevmatski sestavni deli se uporabljajo samo za predvideno uporabo, razen če dobavitelj komponent pisno potrdi alternativno uporabo.

Ventilski otoki in napeljave so narejene tako, da se cevi in žice med predvidenim gibanjem ne obrabljajo in so nepotrebno obremenjene. Vsi senzorji so nameščeni z vtiči, vsi kabli in sestavni deli pa so označeni na napravi in v priloženih shemah.

Elektromagnetni ventili so v glavnem krmiljeni s 24VDC. Če moč preseže 10 W ali zaradi zahtev procesa, se uporabijo 230 VAC tuljave.

Oprema deluje na komprimiran zrak pod tlakom 7 barov, filtriran (5 µm) suh in brez olja.

Glušniki in premeri cevi ne vplivajo na potrebni odzivni čas pnevmatskih komponent.

BARVE PNEVMATSKIH CEVI

Barva		Opis
	siva	napajalni vodi
	modra	delovni gib / gib naprej / rotacija levo
	črna	povratni gib / gib nazaj / rotacija desno
	rdeča	vakuum
	rumena	odzračevalni vodi / izpust kondenzata

1.3.6 OZNAKE

Oznake na napravi so izvedene tako, da so vedno vidne in neizbrisljive tokom redne uporabe in predpisanega čiščenja.

Vse električne in pnevmatske komponente ter povezave so označene v skladu s shemami in kosovnicami. Večpolni in ostali priključki, namenjeni demontaži opreme med selitvijo, so označeni in prikazani v shemah in uporabniškem priročniku.

Naprava je dana v promet z CE označbo v skladnosti z direktivo EU o strojih.

1.4 DOKUMENTACIJA

Dokumentacija naprave je izdelana v skladu z Evropsko direktivo o strojih (2006/42/EC) in splošnimi zahtevami za varnost in električno opremo strojev (EN 60204). Navodila o uporabi vsebujejo naslednja poglavja:

Poglavje	Jezik	
	SI	EN
1. Naziv naprave, proizvajalec in poln naslov	✓	×
2. CE Certifikat o skladnosti	✓	×
3. Splošen opis naprave	✓	×
4. Risbe, sheme in kosovnice	✓	×
5. Delovno področje operaterja	✓	×
6. Namenska uporaba naprave	✓	×
7. Opozorila o predvideni napačne rabi in zdravstvenih tveganj	✓	×
8. Inštalacija, uporaba, transport opreme	✓	×
9. Zmanjševanje hrupa in vibracij	✓	×
10. Uporaba naprave	✓	×
11. Izobraževanje operaterjev in vzdrževalcev	✓	×
12. Preostala tveganja	✓	×
13. Osebna varovalna oprema	✓	×
14. Postopki ob nesrečah, okvarah in zastojih	✓	×
15. Pravilno nastavljanje in vzdrževanje	✓	×
16. Orodja in obrabni deli	✓	×
17. Spisek rezervnih delov	✓	×

1.5 PREVZEMNI POGOJI

PREDPREVZEM (FAT) je izveden pri izvajalcu. Delovanje naprave dve uri z 100% zanesljivostjo glede izdelkov in minimalno 80% zmogljivostjo in razpoložljivostjo naprave. Za izvedbo predprevzema kupec priskrbi potrebno količino ustreznega vhodnega materiala. Material za izvedbo predprevzema mora biti na razpolago izvajalcu štiri tedne pred planiranim predprevzemom če ni drugače navedeno.

KONČNI PREVZEM (SAT) je izveden pri kupcu. Delovanje naprave štiri ure z 100% zanesljivostjo glede izdelkov in minimalno 100% zmogljivostjo in vsaj 95% razpoložljivostjo naprave.

1.6 VZDRŽEVANJE IN TEHNIČNA PODPORA

Odzivni čas tehnične podpore na prijavo napake je v roku 24 ur. Napake se prijavljajo v elektronski ali pisni obliki, ki omogoča beleženje časa prejema napake. Če napake ni možno odpraviti na daljavo ali s pomočjo vzdrževalne službe kupca, dobavitelj pripravi termin pričetka odpravljanja napake ki v garancijskem roku ni daljši od 4 delovnih dni dobavitelja. Izven garancijskega roka se kupec in dobavitelj sporazumeta za nove pogoje podpore.

02 GENERAL EQUIPMENT REQUIREMENTS / SPECIFICATIONS

Equipment is able to run continuously without restitution periods. Wear must only occur on parts that can be changed and are identified in a wear/spare parts list.

Equipment is designed with concern for environment and possible long term effects, giving consideration to:

- Minimised power consumption,
- Noise level below 75dB,
- Use of environmentally friendly materials in construction,
- Creation of waste, dust, aerosols etc.,
- Disposal at the end of the life of the equipment,
- Any other environmental impact of the equipment.

2.1 CE MARKING AND STANDARDS

Equipment is conformed with relevant EU directives and corresponding harmonized standards. Technical dossier can be found at the producer, and equipment is issued with the CE plate and Certificate of conformity.

The following harmonized standards are considered as covering CE conformity according to standard AMTEC.PRO risk assessment, design, build and test procedure:

Standard	Opis
EN 1037:1995+A1:2008	Safety of machinery - Prevention of unexpected start-up
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-1:2015	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015)
EN ISO 13849-2:2012	Safety of machinery - Safety-related parts of control systems - Part 2: Validation (ISO 13849-2:2012)
EN ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design (ISO 13850:2015)
EN ISO 13855:2010	Safety of machinery - Positioning of safeguards with respect to the approach speeds of parts of the human body (ISO 13855:2010)
EN ISO 14120:2015	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards (ISO 14120:2015)
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN 60204-1:2006/A1:2009	Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2005/A1:2008)
EN 61439-1:2011	Low-voltage switchgear and controlgear assemblies - Part 1: General rules (IEC 61439-1:2011)
TR 14121-2:2012	Safety of machinery -- Risk assessment - Part 2: Practical guidance and examples of methods
EN ISO 10218-1:2011	Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots
IEC 61800-5-2-2007	Adjustable speed electrical power drive systems -- Part 5-2: Safety requirements - Functional
EN ISO 13732-1:2008	Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces (ISO 13732-1:2006)
EN 349:1993+A1:2008	Safety of machinery - Minimum gaps to avoid crushing of parts of the human body
EN 60445:2017	Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors
EN 61293:1994	Marking of electrical equipment with ratings related to electrical supply - Safety requirements

2.2 SAFETY

The equipment is designed fail-safe, meaning that all processes have been assessed for most simple safety at design reviews during the design work. The equipment is designed for operation by trained personnel in following modes:

Mode	Primary safety demand	Operated by
Automatic operation	Fail-safe design	Operator
Sequential operation	Fail-safe design	Operator
Manual operation	Fail-safe design	Operator
Change-over/running-in	Fail-safe design	Operator
Calibration	Operated by authorised personnel	Technician
Cleaning	Equipment interrupted/halted	Operator
Maintenance	Operated by authorised personnel	Technician

2.3 DESIGN PRINCIPLES

Equipment is built with a heavy rigid aluminium profiles base structure. If static load, dynamic load or vibrations exceeds structure integrity, welded steel base structure is used.

Light aluminium profiles are used for safety fences and similar peripheral structure.

Mechanical base structure is the foundation of the equipment. All surfaces incorporated in the functionality are straight, perpendicular and/or parallel.

All linear guidance and rotational axes are designed in a way that the motor can be changed without re-alignment of the axes.

Poka Yoke principle is applied to all replaceable format parts.

2.3.1 SURFACE TREATMENT AND COLOURS

All aluminium surfaces are treated with anodizing. All steel surfaces are coloured or browned.

Painted surfaces have colour RAL 7035 Light Grey. Max. 20% of the visible surfaces are another colour.

2.3.2 EQUIPMENT SIZE

Maximum size of the equipment which cannot be dismantled on minor units is 1.800 x 1.300 x 2.100 [mm].

2.3.3 COMPONENTS

Equipment is fitted with component from the following suppliers:

Component	Preferred manufacturer	Substitute manufacturer
Pneumatics	Festo	SMC
Aluminium profiles	Minitec	Bosch-Rexroth
Control cabinets	Made to measure	Schrack
Fuses	Schrack	ETI
Clamps	Weidmueller	
Relais / Contactors	Schrack	
Safety circuits	Sick	
PLC	Siemens	Beckhoff
Servo drives	Festo	
HMI	PC based	Beckhoff
Push buttons	Schneider	
Sensors	Sick	Keyence
Vision	Epson	Cognex
Vision sensors	Sick	Cognex, Keyence
Robot	Epson	Yaskawa
Light beacon	Sirena (LED)	Balluff
Network/bus	Profinet	Modbus
I4.0	OPC UA	

2.3.4 ELECTRICAL

Control components are used only for their intended use unless component supplier confirms an alternative use in writing. Control boards/cabinets and installation on the equipment is done in accordance with applicable regulatory guidelines and in such way that cabling does not suffer unnecessary load and wear during intended motion; all components, wires and plugs are identified on the equipment and in supplied schematics.

Equipment is able to run on power supply from 1x230VAC (50Hz) or 3x400VAC (50Hz).

WIRE COLOURING

Wire colouring for the secondary wiring (after the primary disconnector) is made in accordance with EN-60204-2 $14.2.4:

Colour	Description
Yellow/Green	Protective wire
Black	Power leads (AC and DC)
Red	AC "L" control leads
Light blue	AC "N" control leads
Blue	DC "+" control leads
Blue with white	DC "-" control leads
Orange	Leads for circuits supplied from an external power supply (wires will be »allive« during disconnection from main supply). (Hard wired communication with other controll system supplied from the other panel)
Violet	PLC control leads In (only for signals to I/O terminals)
Gray	PLC control leads Out (only for signals to I/O terminals)
Pink	Safety I/O (only for signals to I/O terminals)

230VAC (6A circuit braker) plug for service is installed, as well as USB and TCP/IP connection plugs.

Enclosure with PLC equipment (control panels) are equipped with a document pocket for electrical schematics.

At the time of the FAT, base plate of the electrical cabinet will be loaded max. 75%; 25% free DIN rails will be foreseen. 15% free I/O will be available, but not installed.

Primary control voltage is 24VDC for all PLC inputs/outputs and supply for remote IO terminals.

Sensors with plug-in are primarily used to ensure fast and simple replacement.

Sensors and switches are 24VDC PNP signal, transmitters 4-20mA

PUSHBUTTONS

Each button is equipped with description in English and local language. If appropriate, light is used within button to signal the status.

Colour	Description
White	On
Black	Off
Blue	Reset
Red	Stop
Yellow	
Green	Start

LIGHT BEACON

Each machine or installation is equipped on the frame with a light beacon with at least the following colours: red and green. Other colours, as well as supplementary beacons are supplied if needed. All beacons are equipped with LED's. Siren is added when operator need to set attention.

Colour	Appearance	Function
red	continuous	Error situation – intervention needed
	blinking	Not used
yellow	continuous	Warning displayed
	blinking	Warning displayed
blue	continuous	Minimum material level
	blinking	Cycle end near
green	continuous	In operation
	blinking	Stand-by (ready for automatic remote restart)
white	continuous	What does not fit above described
	blinking	Not used

2.3.5 PNEUMATICS

Pneumatics are used in situation where it is too expensive or inconvenient to use electrical servo. Pneumatic components are only used for their intended use unless the component supplier confirms an alternative use in writing.

Valve groups and installations are done in such way that tubes and wires do not suffer unnecessary load and wear during intended motion. All sensors are installed with plugs and all cables and components must be identified on the equipment and in supplied diagrams.

Solenoid valves are primarily supplied with 24VDC coils. If the consumption exceeds 10W or due to process requirements, 230VAC coils will be used.

The equipment runs on 7bar pressurized air supply, filtered (5µm) dry and oil free compressed air.

Silencing of exhaust and tube diameters do not hinder necessary response time of the functions in the equipment.

PNEUMATIC TUBE COLOURS

Colour	Description
Grey	Air supply
Blue	Work move / Forward move / Left rotation
Black	Idle move / Backward move / Right rotation
Red	Vacuum
Yellow	Exhaust / Condense release

2.3.6 MARKING

Marking on the machine (signs, flags, stickers etc.) is done in such way that all marking is always visible and not worn during use or prescribed cleaning.

All electrical and pneumatic components and connections are marked in accordance with schematics and bill of material. Multiplugs and other connections, meant for disassembly of the equipment during relocation are marked and identified on schematics and in user manual.

Equipment is issued with CE-mark in conformity with EU Machinery Directive.

2.4 DOCUMENTATION

Equipment is documented as specified in the European Machine Directive (2006/42/EC) and General requirements for electrical equipment in machines (EN 60204). Instruction manual therefore consist of following chapters:

Chapter	Language	
	English	Local
1. Machine name, vendor company name and full address	✓	×
2. CE Certificate of Conformity	✓	×
3. General description of the machine	✓	✓
4. Drawings, schematics, and bill of materials	✓	×
5. Work zone for operator	✓	✓
6. Intended use of the equipment	✓	✓
7. Warning about predictable abuse and health hazards	✓	✓
8. Stable installations, use, moving and relocation of the equipment	✓	×
9. Reduction of noise and vibrations	✓	×
10. Use of the equipment	✓	✓
11. Training of the operators and technicians	✓	✓
12. Remaining risk	✓	✓
13. Personal safety gear	✓	✓
14. Procedures in the event of accidents, breakdown, and blockage	✓	✓
15. Correct and safe adjustment and maintenance	✓	✓
16. Tooling and wear parts	✓	×
17. Spare parts (complete list and list of recommended for stock)	✓	×

2.5 ACCEPTANCE

PRE-ACCEPTANCE is done on manufacturer site. Operation of the device for two hours with 100% certainty regarding products and minimum 80% capacity and availability of the device. To perform pre-acceptance customer should provide the required amount of the appropriate material. Material for the implementation of pre-acceptance should be at the disposal four weeks prior to the scheduled pre-acceptance.

FINAL ACCEPTANCE is made on a buyer premises. Operation of the device four hours with 100% certainty regarding products and minimum 100% capacity, and at least 95% of the availability of the device.

2.6 MAINTENANCE AND TECHNICAL SUPPORT

Response time of technical support to the error report is within 24 hours. Errors are reported in electronic or written form, which allows to record the time of receipt of an error report. If the error cannot be resolved remotely or by customers maintenance service, supplier schedule maintenance service in the warranty period no longer than in 4 working days. Outside the warranty period, the customer and the supplier agree to the new terms of support.