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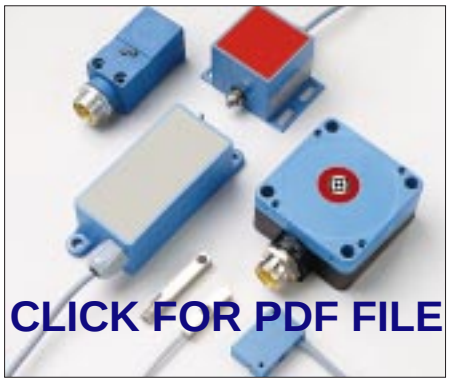

IP Codes (International Protection) Protection Levels - IEC 529/ EN 60529, DIN, VDE 0470 Part 1

IEC 529 outlines an international classification system for the sealing effectiveness of enclosures of electrical equipment against the intrusion into the equipment of foreign bodies (i.e., tools, dust, fingers) and moisture. This classification system utilizes the letter "IP" (International or Ingress Protection) followed by two digits. (An "X" is used for one of the digits if there is only one class of protection; i.e., IP X4 which addresses moisture resistance only.)

First Digit
Degree of protection against contact with moving parts (other than smooth rotating shafts, etc.) and the ingress of solid foreign bodies.

Second Digit
Degree of protection against the harmful entry of various forms of moisture (i.e., dripping, spraying, submersion, etc.

1st digit	Protection From Solid Objects
0	No special protection
1	Protection from a large part of the body such as a hand (but no protection from deliberate access); from solid objects greater than 50mm in diameter.
2	Protection against fingers or other objects not greater than 80mm in length and 12mm in diameter.
3	Protection from entry by tools, wires, etc., with a diameter or thickness greater that 2.5mm
4	Protection from entry by solid objects with a diameter or thickness greater than 1.0mm
5	Protection from the amount of dust that would interfere with the operation of equipment
6	Dust-tight

2st digit	Protection From Moisture
0	No special protection
1	Protection from dripping water
2	Protection from vertically dripping water
3	Protection from sprayed water
4	Protection from splashed water
5	Protection from water projected from a nozzle
6	Protection against heavy seas, or powerful jets of water
7	Protection against immersion
8	Protection against complete continuous submersion in water

Note: All first digits and second digits up to and including characteristic digit **6**, imply compliance also with the requirements for all lower characteristic digits in their respective series (first or second). Second digits **7** and **8** do **not** imply suitability for exposure to water jets (second characteristic digit **5** or **6**) unless dual coded; i.e., **IP _5/IP_7**.

NEMA Enclosure Standards

The following information is derived from the NEMA Standard #250, dated May 1988. Altech is providing this information as a guideline. Please consult the NEMA Standards for your specific requirements.

NEMA REFERENCE NON-HAZARDOUS LOCATIONS	TESTS CONDUCTED
TYPE 1 enclosures are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment.	***Rust entry*** ***Rust resistance***
TYPE 2 enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.	***Rod entry*** ***Drip*** ***Rust resistance***
TYPE 3 enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, and sleet; and to be undamaged by the formation of ice on the enclosure.	***Rain*** ***Dust*** ***External icing*** ***Rust resistance***
TYPE 3R enclosures are intended for outdoor use primarily to provide a degree of protection against falling rain; and to be undamaged by the formation of ice on the enclosure.	***Rod entry*** ***Rain*** ***External icing*** ***Rust resistance***
TYPE 3S enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, and sleet, and to provide for operation of external mechanisms when ice laden.	***Rain*** ***Dust*** ***External icing*** ***Rust resistance***
TYPE 4 enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose directed water.	***Hosedown*** ***External icing*** ***Rust resistance***
TYPE 4X enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose -directed water.	***Hosedown*** ***External icing*** ***Corrosion resistance***
TYPE 6 enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during temporary submersion at a limited depth.	***Submersion*** ***External icing*** ***Rust resistance***
TYPE 6P enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during prolonged submersion at a limited depth.	***Air pressure*** ***External icing*** ***Corrosion resistance***
TYPE 12 enclosures are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids.	***Drip*** ***Dust*** ***Rust resistance***
TYPE 13 enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying water, oil, and non-corrosive coolant.	***Oil exclusion*** ***Rust resistance***

HAZARDOUS LOCATIONS	TESTS CONDUCTED
TYPE 7 enclosures are intended for indoor use in locations classified as Class I, Groups A, B, C, or D, as defined in the *National Electrical Code.*	***Explosion*** ***Hydrostatic*** ***Temperature***
TYPE 9 enclosures are intended for indoor use in locations classified as Class II, Groups E, F or G, as defined in the *National Electrical Code.*	***Dust Penetration*** ***Temperature***

Conversion Chart from L, R, & T Series Sensors to 8 digit Altech part numbers

The chart below is provided to aid our customers who wish to order Altech/Pulsotronic Sensors that have previously been ordered by part numbers beginning with L', 'R' or 'T'. If you have a part with the 'L', 'R' or 'T' designation listed below, the equivalent Altech/Pulsotronic part number is listed for your convenience. Customer service will accept orders with either number.

Model	Specifications same as	Model	Specifications same as	Model	Specifications same as	Model	Specifications same as
L12-A113	9853-2400	T12-A160	9952-0400	T18-A1180	9954-2267	T30-A118	9956-1566
L12-D313	9863-2100	T12-A161	9952-0462	T18-A160	9954-1900	T30-A1180	9956-1567
L12-D413	9863-0400	T12-A1610	9952-0468	T18-A161	9954-1962	T30-A160	9956-1400
R40-A605	9853-3031	T12-A168	9952-0466	T18-A1610	9954-1968	T30-A161	9956-1462
R40-A655	9853-3131	T12-A1680	9952-0467	T18-A168	9954-1966	T30-A1610	9956-1468
R40-A-675	9853-3231	T12-A210	9952-0900	T18-A1680	9954-1967	T30-A168	9956-1466
R40-D305	9863-3333	T12-A211	9952-0962	T18-A210	9954-2600	T30-A1680	9956-1467
R40-D355	9863-3433	T12-A2110	9952-0968	T18-A211	9954-2662	T30-A210	9956-1900
R40-D375	9863-3533	T12-A218	9952-0966	T18-A2110	9954-2668	T30-A211	9956-1962
R40-D405	9863-3033	T12-A2180	9952-0967	T18-A218	9954-2666	T30-A2110	9956-1968
R40-D455	9863-3133	T12-A260	9952-0800	T18-A2180	9954-2667	T30-A218	9956-1966
R40-D475	9863-3233	T12-A261	9952-0862	T18-A260	9954-2500	T30-A2180	9956-1967
T04-D410	9961-1000	T12-A2610	9952-0868	T18-A261	9954-2562	T30-A260	9956-1800
T05-D410	9961-1100	T12-A268	9952-0866	T18-A2610	9954-2568	T30-A261	9956-1862
T08-D310	9907-1900	T12-A2680	9952-0867	T18-A268	9954-2566	T30-A2610	9956-1868
T08-D310L	9961-0300	T12-D310	9962-1500	T18-A2680	9954-2567	T30-A268	9956-1866
T08-D318	9961-0365	T12-D311	9962-4162	T18-D310	9964-1600	T30-A2680	9956-1867
T08-D3180	9961-0363	T12-D318	9962-4165	T18-D311	9964-4162	T30-D310	9966-1200
T08-D360	9907-2100	T12-D3180	9962-4163	T18-D318	9964-4165	T30-D311	9966-4162
T08-D360L	9961-0500	T12-D360	9962-1700	T18-D3180	9964-4163	T30-D318	9966-4165
T08-D368	9961-0565	T12-D361	9962-4362	T18-D360	9964-1800	T30-D3180	9966-4163
T08-D3680	9961-0563	T12-D368	9962-4385	T18-D361	9964-4362	T30-D360	9966-1400
T08-D410	9907-1800	T12-D3680	9962-4363	T18-D368	9964-4365	T30-D361	9966-4362
T08-D410L	9961-0200	T12-D410	9962-1400	T18-D3680	9964-4363	T30-D368	9966-4365
T08-D418	9961-0265	T12-D411	9962-4062	T18-D410	9964-1500	T30-D3680	9966-4363
T08-D4180	9961-0263	T12-D418	9962-4065	T18-D411	9964-4062	T30-D410	9966-1100
T08-D460	9907-2000	T12-D4180	9962-4063	T18-D418	9964-4065	T30-D411	9966-4062
T08-D460L	9961-0400	T12-D460	9962-1600	T18-D4180	9964-4063	T30-D418	9966-4065
T08-D468	9961-0465	T12-D461	9962-4262	T18-D460	9964-1700	T30-D4180	9966-4063
T08-D4680	9961-0463	T12-D468	9962-4265	T18-D461	9964-4262	T30-D460	9966-1300
T12-A110	9952-0500	T12-D4680	9962-4263	T18-D468	9964-4265	T30-D461	9966-4262
T12-A111	9952-0562	T18-A110	9954-2200	T18-D4680	9964-4263	T30-D468	9966-4265
T12-A1110	9952-0568	T18-A111	9954-2262	T30-A110	9956-1500	T30-D4680	9966-4263
T12-A118	9952-0566	T18-A1110	9954-2268	T30-A111	9956-1562	9803-30	9803-3800
T12-A1180	9952-0567	T18-A118	9954-2266	T30-A1110	9956-1568	9803-38	9803-3862

Glossary of Technical Definitions and Terminology

Active Surface:
Portion of the sensor from which the electromagnetic field radiates.

Analog Output:
The output voltage is proportionately to the distance of the target to the sensor's active surface.

Complementary Outputs (N.O. & N.C.):
A proximity sensor that features both normally open and a normally closed output, which can be used simultaneously.

Correction Factors:
Multiplication factors taking into account variations in the target material composition. When calculating actual sensing distance, this figure should be multiplied by the normal sensing distance, Sn.

Current Sinking: See NPN

Current Sourcing: See PNP

Damping Material:

Material which causes a decrease in the strength of the electromagnetic or electrical field produced by the sensing coil.

Differential Travel: See Hysteresis.

Dynamic Output:
A sensor output that outputs a short pulse of a defined period when a target is detected.

Effective Operating Distance - 'Sr':
The operating distance of an individual proximity switch measured at stated temperature and voltage. It takes into account variations in manufacturing tolerances.

Ferrous Metal: Any metal containing iron.

Flush Mounting:
A shielded or embedded proximity sensor can be flush mounted in metal. It can be surrounded by metal up to the active sensing face.

Hysteresis:

The difference, in percentage (%),of the nominal sensing distance between the operate (switch on) and release point (switch off) when the target is moving away from the sensor's active face. Without sufficient hysteresis a proximity sensor will "chatter" (continuously switch on and off) when there is a significant vibration applied to the target or sensor.

Leakage Current:
Current which flows through the output when the output is in an "off" condition or de-energized.

LED:
Light Emitting Diode used to indicate sensor status.

Load:
A device that consumes power to perform a function.

Maximum Load Current:
The maximum current at which the proximity sensor can be continuously operated.

Minimum Inrush Current:
The maximum current level at which the proximity sensor can be operated for a short period of time.

Minimum Load Current:

The minimum amount of current required by the sensor to maintain reliable operation.

Namur Sensor:
A 2-wire, variable resistance sensor which requires a remote amplifier for operation. Typically used in intrinsically safe applications.

Nominal Sensing Distance:

The distance,Sn, at which an approaching target activates (changes state of) the proximity output. This is also called the rated operating distance.

Non-Ferrous Metal:

Any metal which does not contain iron.

Non-Flush Mounting:
Unshielded, or non-embeddable sensors must have a so called "free zone" around the sensor head, with no non-target metal present to operate satisfactorily.

Normally Closed:
Output opens when an object is detected in the active switching area.

Normally Open:
Output closes when an object is detected in the active switching area.

NPN:
The sensor switches the load to the positive terminal. The load should be connected between the sensor output and positive terminal.

Operating Distance, Assured:
Between 0 and 81% of the rated operating distance for inductive proximity switches. It is specified as Sa.

Operating Distance, Rated:
The operating distance specified by the manufacturer and used as a reference value. Also known as nominal sensing distance, Sn.

Overload Protected:
The ability of a sensor to withstand load currents between continuous load rating and a short circuit condition without any damage.

continued...

Glossary, cont.

PNP:
The sensor switches the load to the negative terminal. The load should be connected between the sensor output and negative terminal.

Programmable Output, (N.O. or N.C.):
Output which can be changed from N.O. to N.C. or N.C. to N.O. by way of a switch or jumper wire. Also known as selectable output.

Rated Operating Distance - 'Sn':
Sometimes called nominal operating distance, it does not take into account manufacturing tolerances or variations in temperature or voltage.

Repeatability:
The repeat accuracy of a sensor to detect an object at the same distance away from the active sensing face. It is expressed as a percentage of the sensing distance, or can be calculated as a specific measurement value.

Residual Voltage:
The voltage across the sensor output while energized and switching the maximum load. It is the voltage drop across the sensor.

Response Time: See Switching Frequency

Reverse Polarity Protection:
Proximity sensors which are protected against a reversal in voltage polarity.

Ripple:
The variance between peak-to-peak values in DC voltage. It is expressed as a percentage of rated voltage.

Sensing Face:
A surface of the proximity sensor parallel to the target, from which the operating distance is measured

Shielded:
Sometimes called Flush or Embedded.

Short Circuit Protection:
Sensor protected from damage when a shorted condition exists for an indefinite period of time without change.

Static Output:
A sensor output that stays energized as long as the target is present.

Supply Current:

The current consumed by the proximity switch when the output transistor is in the off condition.

Switching Frequency:
The maximum number of times per second the sensor can change state, (ON and OFF), usually expressed in Hertz (Hz)., as measured by DIN EN 50010.

Target:
Object which activates the sensor.

Temperature Drift:
Specification used to indicate the change in switching point caused by temperature variations within a specified ambient temperature range. Expressed as a percentage of the sensing distance.

Useable Operating Distance - 'Su':
The operating distance measured over a voltage range of 85% to 110% of its rated voltage. It allows for manufacturing tolerances.

Voltage Drop:

The maximum voltage drop across a conducting sensor.

Weld Field Immunity (WFI):

The ability of a sensor not to false trigger in the presence of strong electromagnetic fields.

Wire Break Protection:

The output is off if either power supply wire is broken.

SENSOR HOUSING MATERIALS

Plastics: Trogamid T – Polyamide, used in cylindrical, block and limit style sensors. Hard, rigid, good resistance to chemicals, resists caustic cleaners, approved for food contact.

PBTP: Polybutelyne terephthalate, used in block sensors and front caps of cylindrical nickel plated brass units. Excellent mechanical strength and temperature resistance. Self-extinguishing and flame retardant. Weld splash proof.

PA6.6: Polyamid (Nylon), used in limit style sensors. Excellent mechanical strength, temperature resistant, accepted in food industry.

ABS: Acrylonitrile-Butadiene-Stypol. Used in ring sensors. Impact resistant. Rigid.

PUR: Polyurethane, used in cables and cable assemblies. Elastic, abrasion proof, impact resistant, unaffected by oil, grease and solvents.

PVC: Polyvinylchloride, used on cables and cable assemblies. Good mechanical strength, resistant to chemicals.

PTFE – TEFLON: Used on weld immune cylindrical sensors. Highest resistance to high temperature and chemicals.

METALS: Brass, Nickel Plated, used on cylindrical sensors. Rugged, resists thread damage.

Aluminum, used on block and ring sensors. Lightweight, excellent strength to weight ratio. Resistant to corrosion.

Commonly used metric and other useful conversions

Length		
inch [in.]	x25.4	=millimeters
millimeters [mm]	x0.03937	=inches
meters [m]	x3.281	=feet
miles [mi]	x1.609	=kilometers
kilometers [km]	x0.6214	=miles
Torque		
Newtonmeter [Nm]	x0.738	=lb-ft
lb-ft	x1.356	=Nm
lb-in	x0.113	=Nm
oz-in	x0.0071	=Nm
Power		
kilowatt [kW]	x1.341	=hp
hp	x0.7457	=kW
Moment of Inertia (WR^2)		
lb-ft^2	x0.042	=kgm^2
kilogrammeter^2 [kgm^2]	23.720	=lb-ft^2
Weight Mass and Force		
Newton [N]	x0.02248	=pounds
kilogram [kg]	x2.205	=pounds
pound [lb]	x4.448	=N
pound [lb]	x0.4536	=kg

Metric Cross-Sectional Areas[1]	American Wire Gauge		Metric Cross-Sections Areas[a]	American Wire Gauge	
Cross-Sectional Area mm^2	Equivalent Metric Area mm^2	AWG or MCM	Cross-Sectional Area mm^2	Equivalent Metric Area mm^2	AWG or MCM
0.50	0.519	20 AWG		21.15	4 AWG
	0.653	19	25.0	26.67	3
0.75	0.823	18	35.0	33.63	2
	1.04	17		42.41	1
	1.31	16	50.0	53.48	1/0
1.5				67.43	2/0
	1.65	15	70.0		
	2.08	14	95.0	85.03	3/0
2.5					
	2.62	13		107.20	4/0
	3.31	12	120.0	126.64	250 MCM
4.0	4.17	11	150.0	152.00	300
	5.26	10	185.0	177.35	350
				202.71	400
6.0			240.0	253.35	500
	6.63	9			
	8.37	8	300.0		
			400.0	380.00	750
10.0					
	10.55	7			
	13.30	6	500.0	506.71	1000
16.0	16.77	5	625.0		

[a]As per IEC Publ. 228

DEGREES CELCIUS VERSUS DEGREES FAHRENHEIT

°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	° C	°F
-80	-112.0	-20	-4.0	5	41.0	30	86.0	55	131.0	80	176.0	105	221.0	130	266.0	200	392
-70	-94.0	-19	-2.2	6	42.8	31	87.8	56	132.8	81	177.8	106	222.8	131	267.8	210	410
-60	-65.0	-18	-0.4	7	44.6	32	89.6	57	134.6	82	179.6	107	224.6	132	269.6	220	428
-50	-58	-17	+1.4	8	46.4	33	91.4	58	136.4	83	181.4	108	226.4	133	271.4	230	446
-45	-49.1	-16	3.2	9	48.2	34	93.2	59	138.2	84	183.2	109	228.2	134	273.2	240	464
-40	-40.0	-15	5.0	10	50.0	35	95.0	60	140.0	85	185.0	110	230.0	135	275.0	250	482
-39	-38.2	-14	6.8	11	51.8	36	96.8	61	141.8	86	186.8	111	231.8	136	276.8	300	572
-38	-36.4	-13	8.6	12	53.6	37	98.6	62	143.6	87	188.6	112	233.6	137	278.6	350	662
-37	-34.6	-12	10.4	13	55.4	38	100.4	63	145.4	88	189.4	113	235.4	138	280.4	400	752
-36	32.8	-11	12.2	14	57.2	39	102.2	64	147.2	89	192.2	114	237.2	139	282.2	500	932
-35	-31.0	-10	14.0	15	59.0	40	104.0	65	149.0	90	194.0	115	239.0	140	284.0	600	1112
-34	29.2	-9	15.8	16	60.8	41	105.8	66	150.8	91	195.8	116	240.8	141	285.8	700	1292
-33	-27.4	-8	17.6	17	62.6	42	107.6	67	152.6	92	197.6	117	242.6	142	287.6	800	1472
-32	-25.6	-7	19.4	18	64.4	43	109.4	68	154.4	93	199.4	118	244.4	143	289.4	900	1652
-31	-23.8	-6	21.2	19	66.2	44	111.2	69	156.2	94	201.2	119	246.2	144	291.2	1000	1832
-30	-22.0	-5	23.0	20	68.0	45	113.0	70	158.0	95	203.0	120	248.0	145	293.0	1100	2012
-29	-22.0	-4	24.8	21	69.8	46	114.8	71	159.8	96	204.8	121	249.8	146	294.8	1200	2192
-28	-18.4	-3	26.6	22	71.6	47	116.8	72	161.6	97	206.6	122	251.6	147	296.6	1300	2372
-27	-16.6	-2	28.4	23	73.4	48	118.4	73	163.4	98	208.4	123	253.4	148	298.4	1400	2552
-26	-14.8	-1	30.2	24	75.2	49	120.2	74	165.2	99	210.2	124	255.2	149	300.2	1500	2732
-25	-13.0	0	32.0	25	77.0	50	122.0	75	167.0	100	212.0	125	257.0	150	302.0	1600	2912
-24	-11.2	1	33.8	26	78.8	51	123.8	76	168.8	101	213.8	126	258.8	160	320.0	1700	3092
-23	-9.4	2	35.6	27	80.6	52	125.6	77	170.6	102	215.6	127	260.6	170	338.0	1800	3272
-22	-7.6	3	37.4	28	82.4	53	127.4	78	172.4	103	217.4	128	262.4	180	356.0	1900	3452
-21	-5.8	4	39.2	29	84.2	54	129.2	79	174.2	104	219.2	129	264.2	190	374.0	2000	3632

Conversion Formula °F = 9/5°C + 32° °C = 5/9(°F-32°)

Index by Catalog Number

Index by Catalog Number

FAXBACK

Thank You

We hope this catalog has helped you in your selection of Altech products. To learn more, please complete this form and fax it to us. If you prefer to mail it, fold and seal with clear tape, we've provided the postage.

Name _____ Title _____

Company _____ Div./MS _____

Address _____

City _____ State _____ Zip _____

Phone ( ) _____ Fax ( ) _____

❑ Please contact me to discuss my application. Our product(s) are exported. ❑ Yes ❑ No

My company is best classified as a(n):

❑ OEM ❑ Systems Integrator ❑ Contractor ❑ Consultant
❑ End User/MRO ❑ Distributor ❑ Government/School ❑ Other _____

My primary job function is:

❑ Product Design ❑ Sales/Marketing
❑ System Design ❑ Purchasing
❑ Plant Operations/ Maintenance ❑ Other _____

In my job, I:

❑ Specify ❑ Purchase
❑ Recommend ❑ Other _____
❑ Authorize

Which best describes the end-product produced by your firm?

❑ Controls & Instrumentation
❑ Electronic Systems & Components
❑ Transportation Equipment
❑ Electrical Machinery & Equipment
❑ Specialty Machinery & Equipment
❑ Other _____

Which industry(ies) does your company serve? (Please check all applicable)

❑ Aerospace
❑ Automatic Vending
❑ Agricultural
❑ Automotive
❑ Chemical Processing
❑ Commercial Industrial & HVAC
❑ Construction
❑ Dairy
❑ Defense/Military
❑ Food Processing
❑ Industrial Process Furnaces & Ovens
❑ Machine Tool
❑ Material Handling
❑ Medical & Dental
❑ Metalworking
❑ Mining
❑ Oil & Gas Field
❑ Packaging
❑ Petrochemical
❑ Pharmaceutical Processing
❑ Power Distribution Producing
❑ Primary Metals
❑ Printing & Textiles
❑ Pulp & Paper
❑ Specialty Chemicals
❑ Textiles

Please rush literature on products circled below:

TERMINAL BLOCKS
❑ DIN Rail
❑ Mini DIN Rail
❑ Panel
❑ Eurostrips®
❑ Ceramic
❑ Busbar System
❑ PCB - Fixed
❑ PCB - Pluggable

INTERFACES
❑ Interface Modules

CIRCUIT BREAKERS
❑ Miniature DIN
❑ Motor Controllers
❑ Earth Leakage
❑ Accessories
❑ Power Busbar

ENCLOSURES
❑ Industrial
❑ Electronic
❑ DIN
❑ Strain Reliefs

SENSORS
❑ Proximity Sensors

In Addition:
❑ Inductive Proximity
❑ Capacitive Proximity
❑ Photoelectric Proximity
❑ Ultrasonic Proximity

OTHER
❑ Foot Switches
❑ Disconnect Switches
❑ European Fuses
❑ Safety Relays
❑ Safety Modules
❑ Timers
❑ Monitoring and Sensing Devices