TEST REPORT

Safety Laboratory-MD Team

Report No.: RA/2013/90003
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SHUN HU TECHNOLOGY CO., LTD.
No.21, Zhonggong Rd., Xihu Township, Changhua County 514, Taiwan

The following merchandise was submitted and identified by the vendor as:

Item	Information
Product Description	**Industrial radio remote control systems**
Manufacturer	**SHUN HU TECHNOLOGY CO., LTD.**
Model Number	**Transmitters: K1212** **Receiving units: HM series**
Series Model(s)	**Transmitters:** **K1210,K1208,K1206,K1204,K1202,K1200,K1010,K1008,K1006,K1004,K1002,K1000,** **K808,K806,K804,K802,K800,K606,K604,K602,K600,K404,K402,K400,K202,K200** **Receiving units: HS series, W series, H series**
Software Revsion	**None**

Requirement:

Test Procedures	
Title	**Rev.**
EN ISO 13849-1 Safety of machinery – Safety-related parts of control system Part 1:General principles for design	**2008/AC:2009**

Result:

Conclusion
The result of performance level (PL) for the design of safety function of type model FSD of CNC Drilling comply with the requirement and acceptance conditions of EN ISO 13849-1: 2008/AC:2009. **The detailed description of test result, please see attached sheet(s).**

Signed for and on behalf of

SGS TAIWAN Ltd.

Robert Chang

Robert Chang
Assist. Supervisor

Jason Lin

Jason Lin
Approver

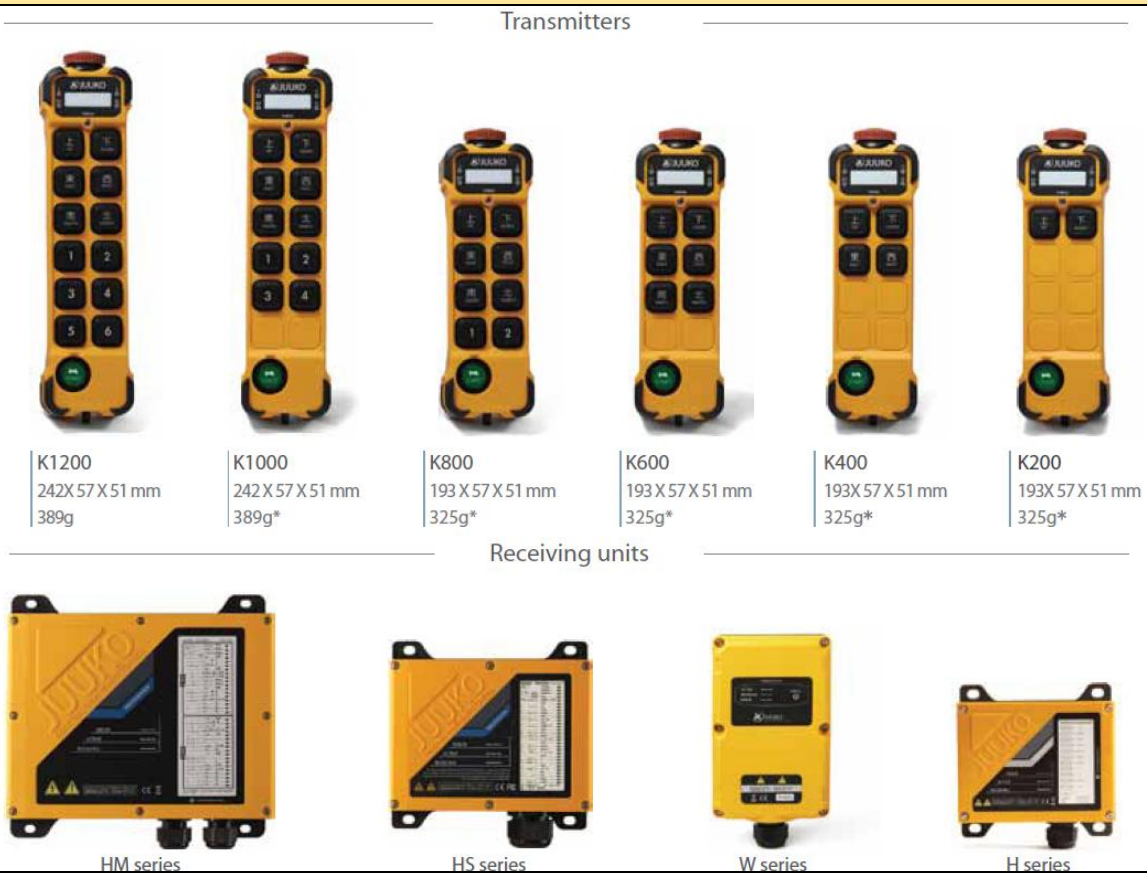
Date of Tests:

Test Started	Test Completed
January 1, 2014	November 18, 2014

Test Equipment:

Name	Brand	Model	Serial No.
NoteBook	Lenovo	L430	
Windows 7 Operating System	Microsoft	Windows 7	

Test Device Photo:

Device Photo


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1. THE PL RESULTS OF SAFETY FUNCTIONS

The results of performance level (PL) for the design of safety function of type model Industrial radio remote control systems were evaluated and calculated in accordance with the standards of EN 13557:2003+A2:2008 and EN ISO 13849-1:2008.

1.1 Safety function check list

Item	Description of safety function	SF ID No	Remark
a)	Emergency stop function	SF1	Safe stop all hazardous movements by STO

1.2 Safety function performance level (PL) requirement and results

No.	Safety functions	PLr	PL	PFH[1/h]	Verdict
SF1	Emergency stop function: Emergency stop control for safe stop of all motors	d	e	9.22E-8	P

Abbreviations: ok / P = passed fail / F = failed n.a. / N = test case does not apply to the test object

2. HAZARD IDENTIFICATION AND RISK ASSESSMENT

Risk graph according to EN ISO 12100

Risk graph is a method to assess the risks, associated with machinery, which makes use of a risk graph. This method allows performing hazard identification, risk estimation, risk reduction and risk evaluation to obtain the aimed goal of risk reduction. The risk assessment is done in two steps:

- First a new machine or an existing machine is assessed, risk reduction means are decided and implemented;
- Then a new risk assessment is made, taking into account the implemented risk reduction measures, including new risks that they may introduce, to verify that the risks have been reduced to the appropriate level; this phase is done iteratively, until appropriate level of risk has been achieved.

  This method can be used for a machine under development, construction or already installed. People who design, maintain, use or are in charge of its safety can use this method after an appropriate training.

  The risk graph for risk estimation, each hazardous situation is described, using the four hazardous conditions (hazard, hazardous situation, hazardous event, possible harm) as defined in EN ISO 12100. A risk index is then calculated using the risk graph given in following Figure , based on the four following parameters, corresponding to the four elements of risk as defined in EN ISO 12100, each one having its particular limits:

Severity of the harm: S

- S1 light injury (usually reversible; examples: scratch, laceration, bruise, light wound requiring first aid, etc.)
- S2 serious injury (usually irreversible, including fatality); examples : broken or torn-out or crushed member; fracture; serious injury with stitch, major musculoskeletal trouble (MST), fatality, etc.

Frequency and/or duration of exposure to hazard: F

- F1 twice or less by work shift or less than 15 min cumulated exposure by work shift;
- F2 more than twice by work shift or more than 15 min cumulated exposure by work shift.

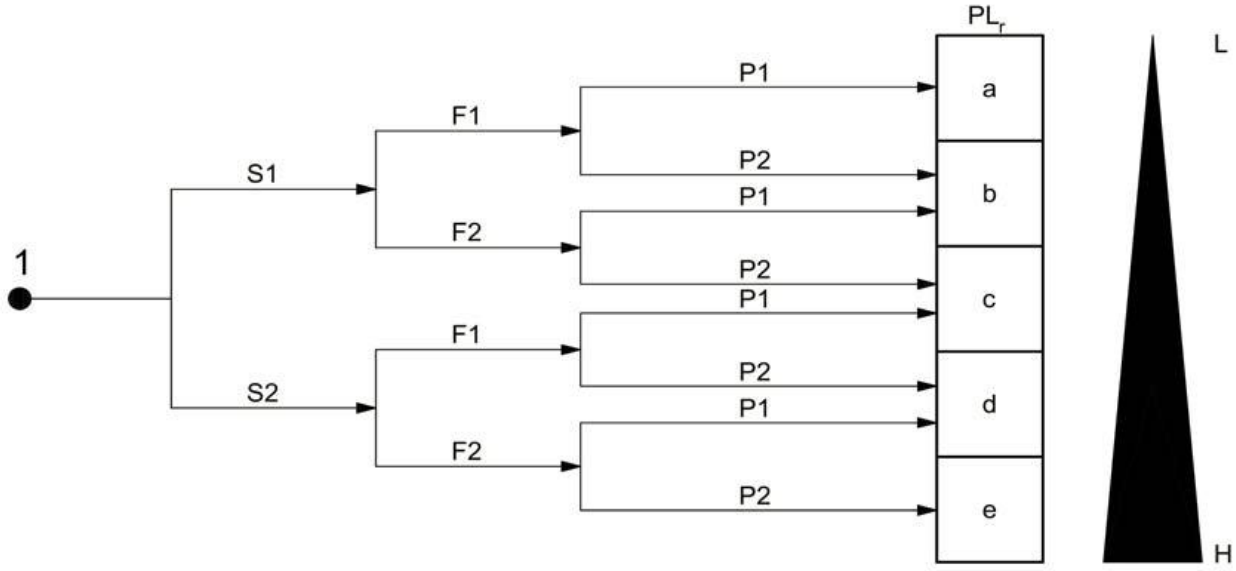
Possibility of avoiding hazard or limiting harm: P

- P1 possible under some conditions:

  - If parts move at a speed less than 0,25 ms^{-1}

  AND the exposed worker is familiar with the risks and with indications of its apparition;

  - depending of particular conditions (temperature, noise, ergonomic, etc.)
- P2 impossible.



Key

1 starting point for evaluation of safety function's contribution to risk reduction

L low contribution to risk reduction

H high contribution to risk reduction

PL_r required performance level

Risk parameters:

S severity of injury

S1 slight (normally reversible injury)

S2 serious (normally irreversible injury or death)

F frequency and/or exposure to hazard

F1 seldom-to-less-often and/or exposure time is short

F2 frequent-to-continuous and/or exposure time is long

P possibility of avoiding hazard or limiting harm

P1 possible under specific conditions

P2 scarcely possible

3. Out looking of the product

4. BLOCK DIAGRAM AND CALCULATION INFORMATION

SF1: Emergency stop control for safe stop of all motors

Safety function:

Emergency stop function, STO – safe torque off by actuation of an emergency stop device

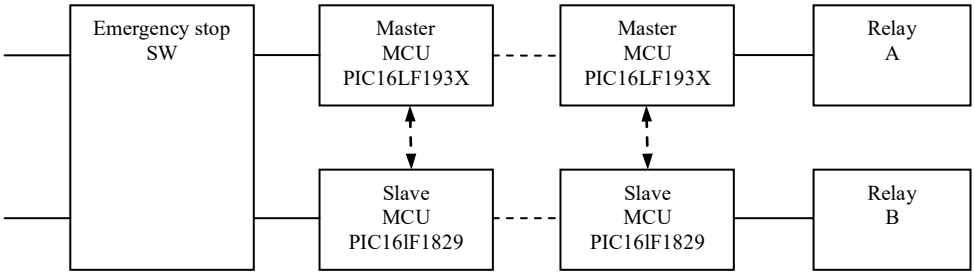
Functional description:

This assessment evaluates the E-stop control on the equipment (the control pendant has a E-stop control switch. The E-stop control switch stops radio transmission from the pendant. This loss of radio communication causes the receiver to de-energize the stop relays and to therefore switch off the output within 500 milliseconds).

Design features:

- Basic safety principles and well-tried safety principles are being used.
- The emergency stop device is switching devices with direct opening contactors in accordance with IEC 60947-5-1.
- EMS is standard emergency stop device to EN ISO 13850.

Block Diagram:



Components description:

Element	Description	Maker	Model No.
SW	Emergency stop button	FUJI	AGX001
Master MCU	Micro Controller	MICROCHIP	PIC16LF193X
Slave MCU	Micro Controller	MICROCHIP	PIC16LF1829
Relay A, B	Control Relay	SCHRACK	SR2M

SF1: Emergency stop control for safe stop of all motors

Elements parameters

Calculation of MTTFd of the safety control system:

Element	Value B10d(cycles)	MTTFd	PFH[1/h]	PL
SW	100,000**[D1]	-	-	-
Master MCU	-	2,433*[D2]	-	-
Slave MCU	-	2,433*[D2]	-	-
Relay A, B	20,000,000**[D3]	-	-	-

*: according to manufacturer data, see Components Datasheet of chapter 5.

**: according to Table C.1 of EN ISO 13849-1.

Assumed operation conditions:

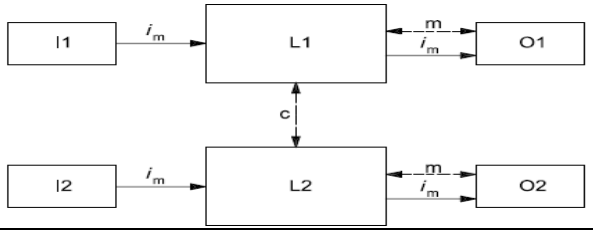
With B_{10d} and n_{op}, the mean number of annual operations, MTTFd for components can be calculated as:

- d_{op}: 300 days (per year)
- h_{op}: 16 hrs (2 shifts × per day)
- t_{cycle}: 120 min. × 60 = 7200 sec. (per cycle)

The Quantification of DCavg:

Element	DC(%)	Remark
SW	99	Safety switches in accordance with IEC/EN 60947-5-1
Master MCU	90	Acc. to manufacturer data
Slave MCU	90	Acc. to manufacturer data
Relay A, B	99	Monitoring by Micro Controller Master MCU and Slave MCU

Category and CCF:

Category	3	Designed and constructed in accordance with category 3: 
CCF	75	See below table

SF1: Emergency stop control for safe stop of all motors

CCF evaluation:

No.	**Measure against CCF**	**Full Score**	**Judge Score**
1	**Separation/ Segregation**		
	Physical separation between signal paths: separation in wiring/piping, sufficient clearances and creep age distances on printed-circuit boards.	15	15
2	**Diversity**		
	Different technologies/design or physical principles are used, for example: first channel programmable electronic and second channel hardwired, kind of initiation, pressure and temperature, Measuring of distance and pressure, digital and analog. Components of different manufactures.	20	0
3	**Design/application/experience**		
3.1	Protection against over-voltage, over-pressure, over-current, etc.	15	15
3.2	Components used are well-tried.	5	5
4	**Assessment/analysis**		
	Are the results of a failure mode and effect analysis taken into account to avoid common-cause-failures in design.	5	0
5	**Competence/training**		
	Have designers/ maintainers been trained to understand the causes and consequences of common cause failures?	5	5
6 **Environmental**			
6.1	Prevention of contamination and electromagnetic compatibility (EMC) against CCF in accordance with appropriate standards. Fluidic systems: filtration of the pressure medium, prevention of dirt intake, drainage of compressed air, e.g. in compliance with the component manufacturers‘ requirements concerning purity of the pressure medium. Electric systems: Has the system been checked for electromagnetic immunity, e.g. as specified in relevant standards against CCF? For combined fluidic and electric systems, both aspects should be considered.	25	25
6.2	Other influences Have the requirements for immunity to all relevant environmental influences such as, temperature, shock, vibration, humidity (e.g. as specified in relevant standards) bee considered?	10	10
	Total	**[max. Achievable 100]**	75
Total score		**Measures for avoiding CCF**[a]	
65 or better		Meets the requirements	
Less than 65		Process failed → choose additional measures	
[a] Where technological measures are not relevant, points attached to this column can be considered in the comprehensive calculation.			

Result:

The whole safety function system, through the SISTEMA calculation (see chapter 6), its performance level: e, PFH: 9.22E-8.

5. COMPONENTS DATASHEET

See the following pages

[D1] Components Datasheet:

Element	Description	Maker	Model No.
EMS	Emergency stop button	FUJI	AGX001

B10d = 100,000

Contact block

KKD06-305, KKD06-304

Terminal	Type
Solder/Tab	**AGX001**
Wire-wrap	**AGX001–W**

■ **Standards approved**

UL508	File No. E44592
CSA C22.2 No.14	File No. LR20479 (except for AH165-2Z, 2ZE, 2SZ, 2SZE) File No. LR84365 (for AH165-2Z, 2ZE, 2SZ, 2SZE)
TÜV: EN60947-5-1	Pushbutton, illuminated pushbutton: R9250087 Selector (except for AH165-2H, SH), illuminated selector: R9250088 Selector (for AH165-2H, SH): R9250087 Pilot lights: R9250089

■ **Specifications (Indoor use)**

Item		AH165-2
Rated insulation voltage		250V AC/DC
Ambient temperature (no condensation or no icing)		–10 to +70°C *1
Humidity		45 to 85%RH (at –5 to +40°C), no condensation or no icing
Durability (operations)	Mechanical	Pushbutton and illuminated pushubutton switch Momentary action: 1 million Alternate action: 250,000 Push-lock, turn-reset: 100,000 With selector ring: 250,000 Selector and illuminated selector switch: 250,000*2
	Electrical	100,000 (220V AC 0.7A)
Dielectric strength		2000V AC, 1 minute (Between lamp and contact terminals: 1500V AC, 1 minute)
Conditional short-circuit current		1000A
Short-circuit protective device		Fuse 1A
Pollution degree		3
Vibration		Resonance: 10 to 55Hz, double amplitude 0.1mm Constant: 16.7Hz, double amplitude 3mm
Shock		Malfunction durability: 100m/s^2 Mechanical durability: 500m/s^2
Operating frequency		1200 operation/hour (on-load factor: 40%)
Insulation resistance		100MΩ or more (500V DC megger)
Operator protection		IP65

[D2] Components Datasheet:

Element	Description	Maker	Model No.
Master MCU	Micro Controller	MICROCHIP	PIC16LF193X
Slave MCU	Micro Controller	MICROCHIP	PIC16LF1829

MTTFd = 2,433

MICROCHIP

HDR and HE Flash Non-polyimide process Qualification Report
#C-081187 Rev.B

Activation Energy	0.6 eV
Derated Temperature	55°C

	Infant Mortality	Total Life	MTTF (Years)
Device Hours	31,872	167,328	N/A
Fit Rate - 50% Confidence	74	14	8,081
Fit Rate - 60% Confidence	98	19	6,111
Fit Rate - 90% Confidence	246	47	2,433

	Best Estimated Failure Rate (%/KHR)
Infant Mortality	0.0074
Total Life	0.0014

[D3] Components Datasheet:

Element	Description	Maker	Model No.
Relay A, B	Control Relay	SCHRACK	SR2M

B10d = 1,000,000

TE connectivity RELAY PRODUCTS

General Purpose Relays
Force Guided Relays

SCHRACK

Force Guided Relay SR2M

- 2 pole relay with force guided contacts according to EN 50205
- Reinforced insulation between poles

Typical applications
Emergency shut-off, press control, machine control, elevator and escalator control, safety relays

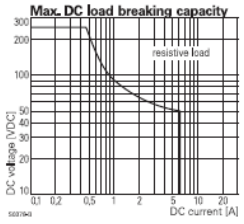
Approvals

VDE 116064, UL E214025, TUV 968/EZ 111, CQC0617015579
Technical data of approved types on request

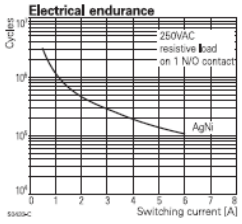
Contact Data

Contact arrangement	1 form A + 1 form B contacts (1 NO + 1 NC) or 2 form C contacts (2 CO)
According EN50205 only 1NO / 1NC (11-14 and 22-21 or 12-11 and 21-24) shall be used as force guided contacts.	
Rated voltage	250VAC
Max. switching voltage	400VAC
Rated current	6A
Contact material	AgNi
Contact style	single contact, force guided
1 form A + B, 1 NO + 1NC	type A according to EN 50205
2 form C, 2CO	type B according to EN 50205
Min. recommended contact load	5V/10mA
Initial contact resistance	≤100mΩ at 1A, 24VDC ≤20Ω at 10mA, 5VDC
Frequency of operation, with/without load	6/300min^{-1}
Contact ratings, IEC60947-5-1,	
on 1 form A (NO) contact	AC15-3A DC13-6A
Mechanical endurance	10x10^6 operations

Max. DC load breaking capacity



Electrical endurance



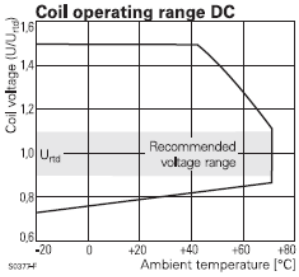
Coil Data (contunied)

Coil versions, DC-coil

Coil code	Rated voltage VDC	Operate voltage VDC	Release voltage VDC	Coil resistance Ω±10%[1]	Rated coil power mW
015	15	11.3	1.5	321	701
018	18	13.5	1.8	483	671
021	21	16	2.1	630	700
024	24	18	2.4	823	700
036	36	27	3.6	1851	700
040	40	30	4.0	2286	700
048	48	36	4.8	3291[1]	700
060	60	45	6	5142[1]	700
080	85	63.8	8.5	9143[1]	790
110	110	83	11	17285[1]	700

[1] Coil resistance ±12%.
All figures are given for coil without pre-energization, at ambient temperature +23°C.

Coil operating range DC



Insulation

Initial dielectric strength

6. EVALUATION REPORT (GENERATED BY SISTEMA SOFTWARE)
7. ELECTRICAL CIRCUIT DIAGRAM

— — —THE END — — —