HIRSCHMANN
A BELDEN BRAND

Mobile Machine Control Solutions

iSCALE Control System

↗ Versatile ↗ Powerful ↗ Safe

Out of sight, but always in control.

iSCALE Control System from Hirschmann MCS

In a world that is increasingly more complex and networked, powerful solutions for mobile equipment applications are a necessity.

Greater demands on hoisting and material handling equipment, combined with today's safety awareness, have increased the functional requirements of mobile control systems. Increased processing speed, extended functionality, and operating reliability are essential even under the most adverse working conditions.

Advances in technological innovation and international competition have caused machine builders to further differentiate their products and reduce manufacturing costs, while maintaining the highest quality and reliability. This is why Hirschmann MCS developed the innovative iSCALE Control System for mobile cranes and any type of mobile plant machinery.

HIRSCHMANN's new Mobile Control Technology is a perfect fit for the job.

HIRSCHMANN's iSCALE Control System offers an innovative system solution focused on mobile plant automation. The system provides a platform for easy customization to application-specific requirements. As a universal automation system, it represents an optimal solution for applications in centralized and distributed configurations.

HIRSCHMANN's modular control system delivers tailor-made hardware and software solutions, designed with a unique set of features to meet specific requirements. This building block approach guarantees efficient, cost-effective solutions that grow along with customers applications.

High-performance solutions that grow along with all challenges.

Modularity and Scalability

These are the defining attributes of the cSCALE control and vSCALE console systems. This flexibility gives OEMs and end-users an economic and space-efficient solution when building their automation system for mobile plant applications.

Performance

The cSCALE systems provide a variety of performance levels. From low-end I/O controllers to high-performance controls for sophisticated mobile automation solutions in harsh environments.

Safety

The SIL2-capable programmable controller of the cSCALE Sx product family incorporates a 32-bit microprocessor and integrated safety system for safety-related applications. This compact controller is designed for use in harsh environments.

Open Standards

The application software can be separated from safety-related software functions and protected against modifications. The operating system offers multi-tasking and user-defined interrupt handling. The application software is programmable according to IEC61131-3 with CoDeSys or in C.

Diagnostics

In addition, the inputs and outputs of cSCALE Sx offer various diagnostic capabilities and are protected against overload and short circuit. A start signal input enables a defined shutdown if the ignition is switched off.

Safety is the most important engineering task

These features make the iSCALE Control System a powerful, safe solution for all mobile appilcations:

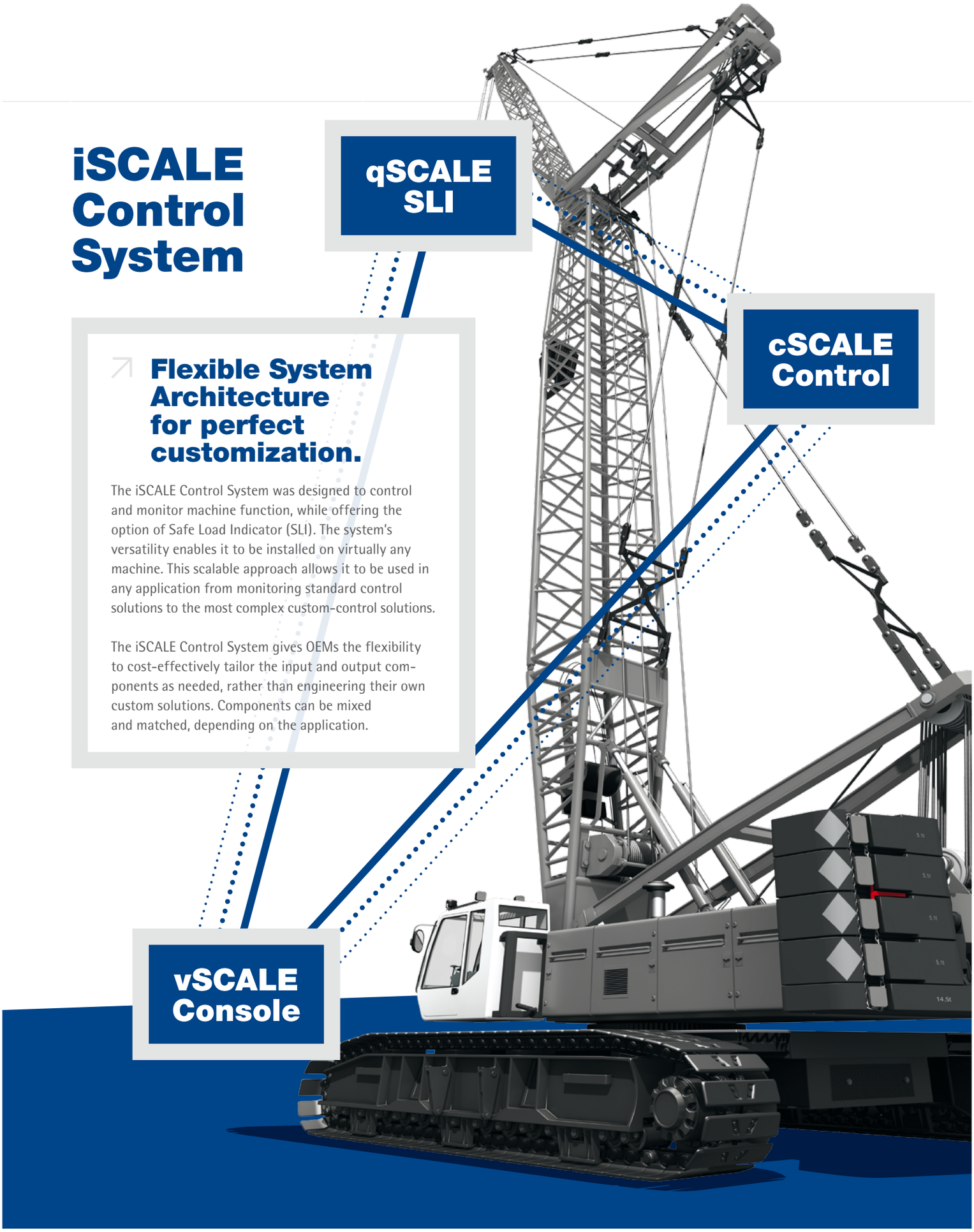
- Compliance with EN 954-SK2, EN IEC 13849-1, and ISO 61508 standards
- Rugged design and high resistance to shock and vibration
- Higher electromagnetic compatibility levels than standards require
- Extended operating temperature range
- Protection against humidity, powder, water, and saline fog
- Modular I/O configuration
- PWM outputs to directly drive solenoids and hydraulic proportional valves
- Enhanced calculation functions
- Complete auto-diagnostic system
- Integrated software function blocks such as Safe Load Indicator (SLI)
- Data logger to record customizable information on events, alarms, overloads, lifting cycles, and counters
- The iSCALE Control System incorportes powerful auto-diagnostics and monitoring functions that are designed to promptly recognize errors or faults

iSCALE Control System

Flexible System Architecture for perfect customization.

The iSCALE Control System was designed to control and monitor machine function, while offering the option of Safe Load Indicator (SLI). The system's versatility enables it to be installed on virtually any machine. This scalable approach allows it to be used in any application from monitoring standard control solutions to the most complex custom-control solutions.

The iSCALE Control System gives OEMs the flexibility to cost-effectively tailor the input and output components as needed, rather than engineering their own custom solutions. Components can be mixed and matched, depending on the application.



cSCALE

The new Control System consists of CPUs ranging from low-end to high-end controls that are available in different IP classes. The controls combine 32-bit microprocessor technology with an integrated system for safety-related applications in a compact housing designed for harsh environments.

IP20 Compact/Mid-Range & High-End Control

- cSCALE Cx
- cSCALE Sx

IP66/67 Compact/Mid-Range & High-End-Control

- cSCALE Cx
- cSCALE Sx

Control Integrated in Consoles

- cSCALE Ix

qSCALE

qSCALE offers a range of SLI solutions for various mobile crane applications including latest safety requirements, higher accuracy and reduced calibration time. The qSCALE SLI product solutions are designed to be used for any OEM and Retrofit mobile crane, regardless of size.
Cost-effective solution with the integrated SLI (qSCALE I2) or expandable qSCALE Cx and Sx.

IP20 SLI for Telescope & Lattice Boom Cranes

- qSCALE Cx
- qSCALE Sx

IP66/67 SLI for Telescope & Lattice Boom Cranes

- qSCALE Cx
- qSCALE Sx

SLI integrated in Consoles for small Telescope Cranes (non PLd)

- qSCALE I2

vSCALE

The vSCALE Stand-alone Console features an integrated Graphic CPU using standard communication to the vSCALE Control System where the Console with Integrated PLC-Control offers a compact solution for small applications including HMI visualisation and Real-time PLC-Control.

vSCALE C2

- 4.3" Compact Consoles

vSCALE D2

- 4.3" Consoles with function keys and Rotary encoders

vSCALE D3

- 7" Consoles with function keys and Rotary encoders

vSCALE D6

- 12" Consoles with function keys and Rotary encoders

vSCALE Consoles

The vSCALE console family features a variety of display sizes and resolutions, with optional touch screen, function keys, and rotary encoder. Each console is designed for use in extreme environmental conditions with temperatures ranging from -30 °C to +70 °C (-22 °F to +158 °F).

Versatile

- In-dash or On-dash mounting
- Landscape or Portrait Orientation
- Stand-alone Console or Console with integrated PLC-Control
- Ethernet, CAN (different CAN Protocols) and USB Communication Interfaces
- Integrated In- / Outputs

Easy to operate

- Ergonomically designed
- Function keys (soft keys and hard keys), Rotary encoder, and LED Indicators
- True Outdoor Housing with IP66/67 protection
- LED backlight
- Up to 4 GB mass memory

Options

- Touch Screen
- Video Inputs with Video Overlay
- Compact Version with Touch Screen only
- Bluetooth, GPS/GSM, WLAN
- Integrated PLC-Control
- Integrated Safe Load Indicator (SLI)

vSCALE C2

vSCALE C3

vSCALE D2

vSCALE D3

vSCALE D3

vSCALE D6

vSCALE with SLI application

General Technical Data

Description	vSCALE with SLI application
Supply Voltage	8 ... 36 Vmax. DC
Operating Temperature	-30 °C to +70 °C (-22 °F to +158 °F) -40 °C (-40 °F) version on request
Mounting	in-dash or on-dash (only requires different mounting accessories)
Protection Class	IP66/67
Buzzer	internal buzzer 65 dBA, output for external buzzer
Ethernet Interface	10/100 Mbit/s Base T, TCP/IP, M12 connector
CAN protocols	CANopen, J1939, others on request

Select the vSCALE Console to specific requirements

	vSCALE Versions	Order Code	Display	Resolution	Function Keys	Rotary Encoder	Status LEDs	CAN Interfaces	Ethernet Interface	USB (Front)	USB (Back-side)	Video Interfaces (FBAS)	Touch	Flash (GB)	I/Os (4x AI/DI, 3x DO)	HOR / VER	cSCALE Control integrated	qSCALE I2 SLI integrated	CoDeSys
vSCALE x2	**vSCALE C2 - C1**	608534	4,3"	480 x 272	-	-	1	2	-	-	1	-	-	0,5	-	X	-	-	X
	vSCALE C2 - C2	608536	4,3"	480 x 272	-	-	1	2	1	-	1	1	X	0,5	X	X	-	-	X
	cSCALE I2 - CC2	608730	4,3"	480 x 272	-	-	1	2	1	-	1	1	X	0,5	X	X	X	-	X
	vSCALE D2 - C1	608413	4,3"	480 x 272	11	X	3+1	2	1	1	1	1	-	0,5	X	X	-	-	X
	vSCALE D2 - C2	608414	4,3"	480 x 272	11	X	3+1	2	1	1	1	1	X	1,0	X	X	-	-	X
	cSCALE I2 - DC1	608731	4,3"	480 x 272	11	X	3+1	2	1	1	1	1	-	0,5	X	X	X	-	X
	qSCALE I2 - DC1	608732	4,3"	480 x 272	11	X	3+1	2	1	1	1	1	-	0,5	X	X	X	X	X
	vSCALE C2 - S1	608733	4,3"	480 x 272	-	-	1	2	-	-	1	-	-	0,5	-	X	-	-	-
	vSCALE C2 - S2	608734	4,3"	480 x 272	-	-	1	2	1	-	1	1	X	0,5	X	X	-	-	-
	vSCALE D2 - S1	608430	4,3"	480 x 272	11	X	3+1	2	1	1	1	1	-	0,5	X	X	-	-	-
	vSCALE D2 - S2	608432	4,3"	480 x 272	11	X	3+1	2	1	1	1	1	X	1,0	X	X	-	-	-
vSCALE x3	**vSCALE D3 - C1**	608415	7"	800 x 480	15	X	3+1	2	X	1	1	1	-	1,0	-	X	-	-	X
	vSCALE D3 - C2	608416	7"	800 x 480	15	X	3+1	2	X	1	1	3	X	1,0	X	X	-	-	X
	vSCALE C3 - C2	608684	7"	800 x 480	-	-	0	2	X	-	1	3	X	1,0	X	X	-	-	X
	vSCALE D3 - S1	608436	7"	800 x 480	15	X	3+1	2	X	1	1	1	-	1,0	-	X	-	-	-
	vSCALE D3 - S2	608438	7"	800 x 480	15	X	3+1	2	X	1	1	3	X	1,0	X	X	-	-	-

CPU Modules

A full range of powerful 32-bit CPUs with a fully integrated Safety Controller for supervision and diagnostics of the main controllers and integrated technological functions are available for the iSCALE Control System.

One common software platform for the complete controller range offers full software compatibility, so that the same application software can run on all CPUs. Program or firmware updates are implemented easily with an USB Memory Stick. All cSCALE CPUs are designed for use under extreme external environmental conditions, i. e. with an extended temperature range from – 40° C up to + 70° C. Systems without CPU are also available as Expansion Rack (IP20) or Module (IP66/67).

Programming: The iSCALE Control System is programmable according to IEC 61131-3 with CoDeSys or alternatively in C.
All CPUs are also available with an embedded SLI Library for different crane types with the product name qSCALE (usable with CoDeSys).

CPU

cSCALE / qSCALE (IP20 & IP66/67) CPU and I/O Expansion Modules

	cSCALE / qSCALE C2 Basic CPU	cSCALE / qSCALE S6 Mid-Range CPU	cSCALE / qSCALE S8 High-End SIL2 CPU*	cSCALE Local I/O Expansion Rack/Module	cSCALE Distributed I/O (only IP66/67)
CPU	32-bit / 333 MHz	32-bit / 500 MHz	32-bit / 500 MHz	–	–
Flash	16 MB	48 MB	48 MB	–	–
RAM	64 MB	128 MB	128 MB	–	–
RAM battery backed	512 kB	2 MB	2 MB	–	–
Optional Micro SD Card	–	•	•	–	–
FPU (HW)	–	–	•	–	–
Ethernet 10/100 base-T	•	•	•	–	–
USB 2.0	•	•	•	–	–
CANopen / Canopen Safety	•	•	•	•	•
J1939	•	•	•	–	–
SYS Extension	•	•	•	–	–
Integrated SLI/LMI Libary (optional)	with qSCALE	with qSCALE	with qSCALE	–	–
EN954 Classification	SK 2	SK 2	–	SK 2	–
EN13849-1 Classification	Cat. 2	Cat. 2	PL d, Cat. 3	Cat. 2	–
SIL Classification	–	–	SIL 2	–	–
Order Code	C2	S6	S8	IX	DX

* Future release

The Power Supply Module: High-performance, safe, and durable.

The power supplies of the iSCALE Control System are designed for use on Mobile Plant Applications. The DC/DC power supply is fully protected as a system point of load power supply, featured with an Active Over Voltage Limitation (OVL) according to ISO 7637-2, Puls 1 up to 4 and 5B (>80V at 2Ω).

The power supplies are already equipped with some I/Os as well as with 2 serially connected safety cut-off relays to meet EN 13000 requirements, for example.

- U_b 8V$_{min.}$ up to 48V$_{max.}$ (AMN: U_b 6V up to 33V$_{max.}$)
- Reverse Voltage Protection up to 100V
- Short Circuit Protection
- Low-Pass Filter
- Active Over Voltage Protection
- Safety Cut-Off Relays
- Diagnostic LEDs: (Power ON, Power OK, Safety Relay ON, RUN, Error, S1-free programmable LED)

Communication Options

To adapt the iSCALE Control System to the specific requirements, several communication modules are available as an option.

IP20		Order Code
CAN extensions	3x Sub-D 5x M12 (only for cSCALE S6 with galvanic isolation)	C3 C5
Ethernet*	4x RJ45	E4
IP66/67		
CAN extensions	2 x M12 + SYS EXT 3 x M12 w/o SYS EXT	C2 C3

* Future release

I/O Modules of iSCALE Control Systems

The iSCALE Control System features a wide range of specialized input and output options including PWM outputs with current control or DIAG inputs with additional diagnostics. Self-testability of all safety declared I/Os is integrated.

The DI DIAG inputs provide the following diagnostics with external:

- Short to Battery
- Short to Ground
- Open Load

All digital outputs use the new generation of high voltage PROFET technology with integrated short-circuit, TVS, and overheating protection. The PWM outputs offer a high crest factor of 4 A for 2 A and 2.25 A for 4 A outputs. The current control of the PWM outputs can be configured between 50 Hz and 400 Hz.

The following I/Os could be used as safety declared I/Os according to EN ISO 13849-1 Cat. 2 with Performance Level PL d (or SIL 2):

- Digital Input — DI DIAG
- Digital Input for NAMUR sensor — DI NAMUR
- Analog Input (11 Bit) — AI
- Digital PWM Output with Current Control — DO PWM w/CC
- Digital Static Output — DO

cSCALE (IP20) PS and I/O Modules

Besides the CPU and the Power Supply, each IP 20 main rack can be configured with up to 6 I/O module options. The maximum configuration of an expansion rack contains one Power Supply and up to 6 I/ O module options.

PS and I/O Modules for IP20 systems

	PS5- I/O 01	PS5N- I/O 01	I/O 03-02	I/O 05-05	I/O 06-06	I/O 04-03	I/O N4-N3	I/O 06-05	I/O 04-02	I/O 04-04	I/O N4-N4
DI w/HSC option	–	–	4	–	–	8	8	–	12	16	16
DI DIAG	8	8	8	–	–	12	–	–	12	16	–
DI NAMUR	–	–	–	–	–	–	12	–	–	–	16
AI 4 – 20 mA 0 – 10 V	–	–	8–4 0–4 *	–	–	8–4 0–4 *	8–4 0–4 *	–	–	–	–
DO (1 Aav)	4	4	4 **	24 **	–	–	–	12 **	12 **	–	–
DO PWM w / CC (2 Aav)	4	4	4 **	–	12 ***	–	–	6 ***	4 **	–	–
DO PWM w / CC (4 Aav)	–	–	–	–	4 ***	–	–	2 ***	–	–	–
Cut-Off relay	1 + 1	1 + 1	–	–	–	–	–	–	–	–	–
8.2V Power Supply (500 mA)	–	•	–	–	–	–	–	–	–	–	–
DO-relay	–	–	–	–	–	–	–	–	–	–	–
Order Code	A01	B01	32	55	66	43	DC	65	42	44	DD

* Selection of voltage input reduces number of current input ** I/O 02, I/005 cell /DO (1 A_{av}): Sum of current 8 A_{av} *** I/O 06 cell /DO PWM w/CC: Sum of current 12 A_{av}

cSCALE (IP66/67) PS and I/O Modules

Besides a basic set of integrated I/Os (see IP66/67 I/O module matrix for details), the IP66/67 version also has additional modular I/O and communication options. The basic housing supports 2 additional options where the extended housing supports up to 6 optional modules.

PS and I/O MOdules for IP66/67 systems

	PS5- I/O 03-02	PS5N- I/O 03-02	PS5- I/011-12	PS5- I/011-12	PS5- I/011	I/O 02	I/O 03	I/O 04	I/O N4	I/O 05	I/O 06
DI w/HSC option	4	4	14 ****	14 ****	10 *****	4	–	8	8	–	–
DI DIAG	8	8	2 (Pos.Logic only)	2 (Pos.Logic only)	2 (Pos.Logic only)	4	4	8	–	–	–
DI NAMUR	–	–	–	–	–	–	–	–	8	–	–
AI 4 – 20 mA 0 – 10 V	8–4 0–4 *	8–4 0–4 *	8 see AI 0 - UB	8 see AI 0 - UB	8 see AI 0 - UB	– –	8–4 0–4 *	– –	– –	– –	– –
AI 0 - UB (max. 36V), usable also as AI 0-10 V or DI	–	–	8	8	0	–	–	–	–	–	–
DO (1 Aav)	4 **	4 **	16	16	4 **	4 **	–	–	–	12 **	–
DO PWM w / CC (2 Aav)	4 **	4 **	6	6	4 **	4 **	–	–	–	–	6 ***
DO PWM w / CC (4 Aav)	–	–	2	2	–	–	–	–	–	–	2 ***
Cut-Off relay	1+1	1+1	1+1	1+1	1+1	–	–	–	–	–	–
8.2V Power Supply (500 mA)	–	•	–	•	–	–	–	–	–	–	–
DO-relay	–	–	–	–	–	–	–	–	–	–	–
Order Code	A32	B32	AMN	BMN	AMO	02	03	04	OD	05	06

* Selection of voltage input reduces number of current input ** Sum of current 8 A_{av} *** I/O 06 cell /DO PWM w/CC: Sum of current 12 A_{av} **** 8 w/ HSC option ***** 4 w/ HSC option

Configure the iSCALE Control System to specific requirements

This matrix helps to configure your iSCALE Control System to be fully customized to the needs and application.

iSCALE Control System – Configuration Matrix

	Type	Order Code	CPU	-	IP	Power Supply	Comm. Option 1	Comm. Option 2	-	I/O	I/O	I/O	I/O	I/O	I/O	-	SD
CPUs																	
cSCALE C2 Basic CPU	c	C2		-					-							-	
cSCALE S6 Mid-Range CPU	c	S6		-					-							-	
cSCALE S8 High-End SIL2 CPU *	c	S8		-					-							-	
qSCALE C2 Basic SLI/LMI CPU	q	C2		-					-							-	
qSCALE S6 Mid-Range SLI/LMI CPU	q	S6		-					-							-	
qSCALE S8 High-End SLI/LMI SIL2 CPU *	q	S8		-					-							-	
Option Micro-SD (2GB) **		1 / 2		-					-							-	
Local I/O Expansion		IX		-					-							-	
Distributed I/O		DX		-					-							-	
Protection Classes																	
IP20		20		-					-							-	
IP66/67		66		-					-							-	
IP69K *		69															
Power Supplies																	
IP20: PS + I/O 01		A01		-					-							-	
IP20: PSN + I/O 01 + PS 8.2V (500mA)		B01		-					-							-	
IP6x: PS + I/O 03-02		A32		-					-							-	
IP6x: PSN + I/O 03-02 + PS 8.2V (500mA)		B32		-					-							-	
IP6x: PS + I/O 11-12		AMN		-					-							-	
IP6x: PS + I/O 11-12 + PS 8.2V (500mA)		BMN		-					-							-	
IP6x: PS + I/O 11		AM0		-					-							-	
Communication (optional)																	
IP20: 3 x CAN Expansion		C3		-					-							-	
IP20: 5 x CAN Expansion **		C5		-					-							-	
IP6x: 2 x CAN Expansion + SYS EXT		C2		-					-							-	
IP6x: 3 x CAN Expansion		C3		-					-							-	
I/O Modules (optional)																	
IP20: I/O 03-02		32		-					-							-	
IP20: I/O 05-05		55		-					-							-	
IP20: I/O 06-06		66		-					-							-	
IP20: I/O 06-05 *		65		-					-							-	
IP20: I/O 04-03		43		-					-							-	
IP20: I/O N4-N3		DC		-					-							-	
IP20: I/O 04-02 *		42		-					-							-	
IP20: I/O 04-04 *		44		-					-							-	
IP20: I/O N4-N4 *		DD		-					-							-	
IP6x: Module 2		02		-					-							-	
IP6x: Module 3		03		-					-							-	
IP6x: Module 4		04		-					-							-	
IP6x: Module N4		0D		-					-							-	
IP6x: Module 5		05		-					-							-	
IP6x: Module 6		06		-					-							-	
Summary of your configuration (order code for not selected communication and I/O options = 00)																	
Order Code		SCALE		-					-							-	

* Future Release ** only available with CPU S6, S8

Out of sight but always in control

iSCALE Control System

The iSCALE Control System can be used on mobile applications

Of any size:

- Scalable architecture delivers tailored control solutions
- From compact controller up to controller with more than 200I/Os
- High-performance CPU available with sufficient data and program memory

Of any complexity:

- Embedded Ethernet connectivity for networked control and HMI systems
- Support for distributed control architectures for mobile plant automation

With any safety requirements:

- cSCALE is a PLd/SIL2-compliant control system
- cSCALE supports fully redundant system architectures
- Stand-by control system

Requiring any type of communication:

- Embedded Ethernet
- CANopen, CANopen Safety, J1939
- Customized CAN protocols

HIRSCHMANN
A BELDEN BRAND

Global Partnership

↗ **Visionary** ↗ **Experienced** ↗ **Supportive**

Hirschmann MCS leads the world market in safe load indication for telescopic and lattice-boom cranes.

Offering systems and innovative mobile automation platforms for applications in harsh environments, Hirschmann sets new standards in meeting safety and in its design of hardware and software.

The company's experienced team has provided communication between people and machines for more than 40 years. All solutions from Hirschmann MCS already meet tomorrow's special requirements and today´s standards.

Mobile Machine Control Solutions

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