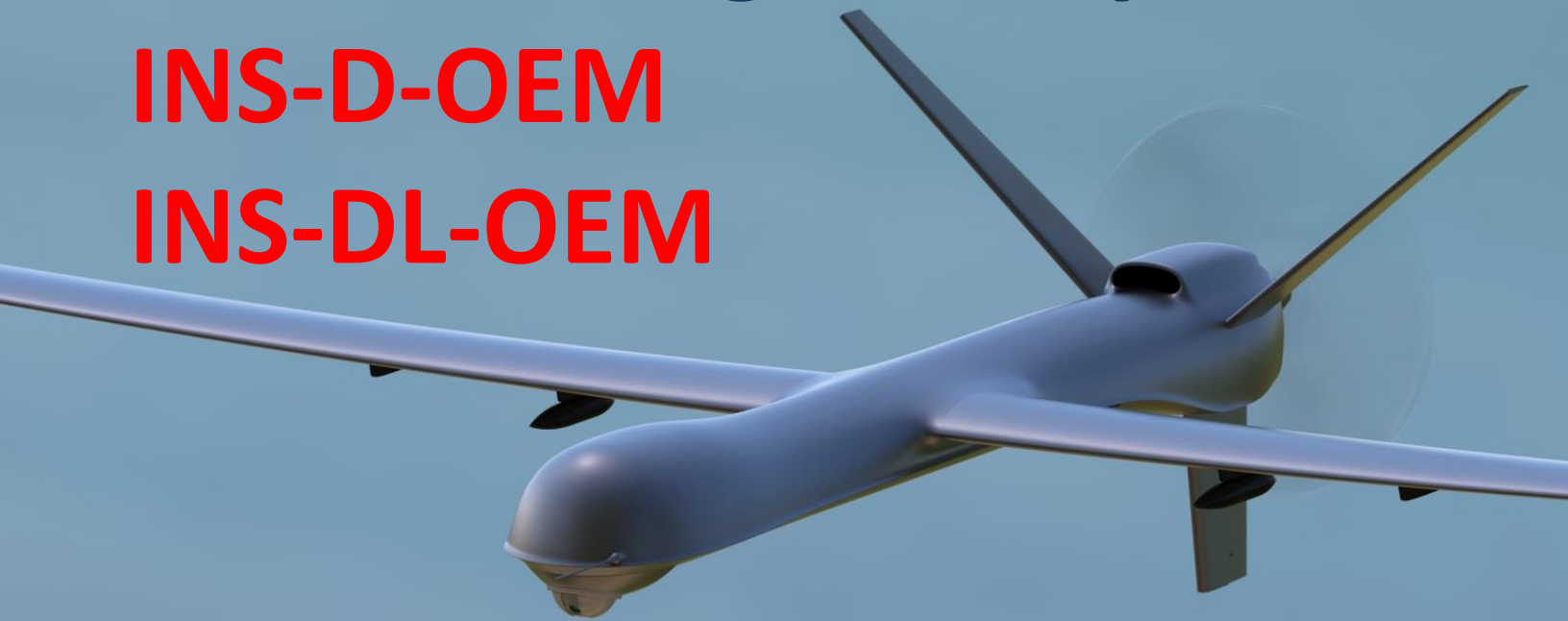




Dual Antenna, GPS-Aided Inertial Navigation Systems

INS-D-OEM

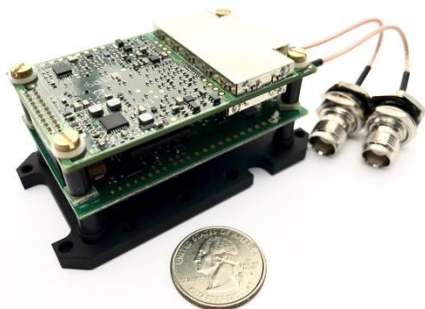
INS-DL-OEM



- Real time (RTK) & Post Processing (PPK)
- Position accuracy = 0.5 cm (PPK) / 1 cm (RTK)
- Heading accuracy = 0.03 deg (PPK) / 0.05 deg (RTK)
- Pitch & Roll accuracy = 0.006 deg (PPK) / 0.08 deg (RTK)
- High precision dual antenna GNSS receiver
- Ideal solution for accurate point clouds
- Small Size, light weight
- Affordable price
- Compatible with LIDAR, Optical camera
- Applications: flight control, remote sensing, photogrammetry



The **Inertial Labs GPS-Aided Inertial Navigation System (INS-D/DL-OEM)** is OEM version of new generation, dual GNSS antenna, fully-integrated, combined GPS, GLONASS, GALILEO and BEIDOU GNSS and high-performance strapdown system, that determines position, velocity and absolute orientation (Heading, Pitch and Roll) for any device on which it is mounted. Horizontal and Vertical Position, Velocity, Dual Antenna Heading, Pitch & Roll are determined with high accuracy for both motionless and dynamic applications.



The Inertial Labs **INS-D/DL-OEM** utilizes advanced dual antenna GNSS receiver, 3-axes each of calibrated in full operational temperature range Advanced MEMS Accelerometers and new generation of tactical grade MEMS Gyroscopes to provide accurate Position, Velocity, Heading, Pitch and Roll of the device under measure.

INS-D/DL-OEM contains Inertial Labs new on-board sensors fusion filter, state of the art navigation and guidance algorithms and calibration software.

KEY FEATURES, BENEFITS & FUNCTIONALITY

- Commercially exportable Dual Antenna GPS-Aided Inertial Navigation System
- 85.5 x 47.7 x 40 mm size and 174 (or 184) grams in mass. Full temperature calibration of all sensing elements
- Industrial & Tactical-grade IMU (1 – 3 deg/hr gyroscopes Bias in-run stability)
- GPS, GLONASS, BEIDOU, SBAS, DGPS, RTK supported signals
- Up to 0.05 deg Heading and 0.08 deg Pitch & Roll accuracy
- Compatibility with LiDARs and Optical Cameras for remote sensing applications
- Up to 200 Hz INS, up to 2000 Hz IMU, up to 100 Hz GNSS positions and GNSS measurements data rate
- Advanced, extendable, embedded Kalman Filter based sensor fusion algorithms
- State-of-the-art algorithms for different dynamic motions of Vessels, Ships, Helicopters, UAV, UUV, UGV, AGV, ROV, Gimbals and Land Vehicles
- Implemented ZUPT, GNSS tracking angle features

INS-D-OEM and INS-DL-OEM performance during GNSS outages

Model	Outage duration	Mode	Position accuracy (meters, RMS)		Velocity accuracy (meters/sec, RMS)		Attitude accuracy (degree, RMS)	
			Horizontal	Vertical	Horizontal	Vertical	Pitch, Roll	Heading*
INS-D-OEM	0 sec	RTK	0.01 + 1ppm	0.02 + 1ppm	0.02	0.01	0.015	0.05
		SP	1.2	1.0	0.03	0.02	0.08	0.08
		PP	0.005	0.01	0.02	0.01	0.006	0.03
	60 sec	RTK	7	2	0.3	0.1	0.05	0.08
		SP	8	3	0.3	0.1	0.1	0.1
		PP	0.3	0.2	0.03	0.05	0.01	0.05
INS-DL-OEM	0 sec	RTK	0.01 + 1ppm	0.02 + 1ppm	0.05	0.05	0.09	0.2
		SP	1.2	1.0	0.06	0.06	0.1	0.3
	60 sec	RTK	8	3	0.5	0.4	0.06	0.3
		SP	9	4	0.6	0.5	0.15	0.4

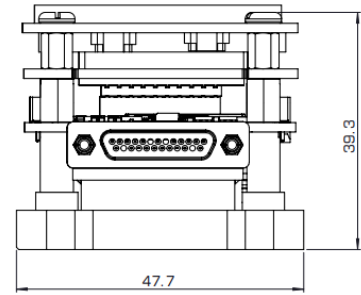
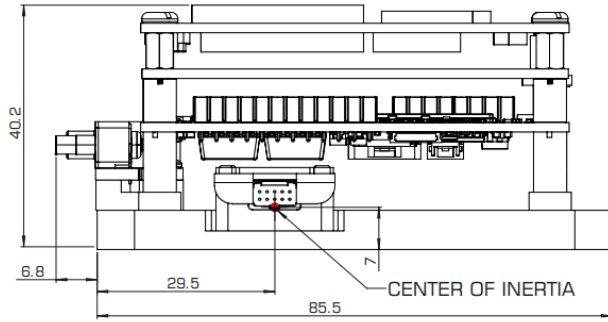
* 2 meters baseline

Specifications

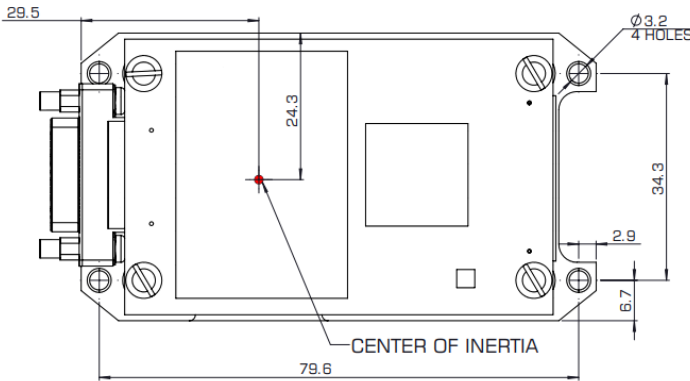
	Parameter	Units	INS-DL-OEM	INS-D-OEM
			Low cost dual antenna	High precision dual antenna
General	Input signals		<ul style="list-style-type: none"> Marine application: DVL (Doppler Velocity Log) Land application: Odometer, Wheel sensor, Encoder, DMI Aerial application: Wind sensor, Air Speed Sensor, Doppler shift from locator (for long-term GPS denied) All: External Stand-Alone Magnetic Compass (SAMC/AHRS) 	
	Output signals		<ul style="list-style-type: none"> Horizontal and Vertical Positions, Heading, Pitch & Roll, Velocity, Accelerations, Angular rates, Barometric data, PPS Direct AT_ITINS message with Position, Heading, Pitch & Roll to COBHAM AVIATOR UAV 200 Direct Navigation Support for Pixhawk Flight Controllers as NMEA messages 	
	Main features		Affordable price Dual antenna Heading 1 cm RTK position	High precision dual antenna Heading, 1 cm RTK position, Tactical-grade IMU
	Data rate (INS)	Hz	Up to 200 (user settable)	Up to 200 (user settable)
	Data rate (IMU)	Hz	Up to 2000 (user settable)	Up to 2000 (user settable)
	Start-up time	sec	<1	<1
	Positions, Velocity and Timestamps	Units	INS-DL-OEM	INS-D-OEM
Navigation	Horizontal position accuracy (SP, L1), RMS	meters	1.5	1.5
	Horizontal position accuracy (SP, L1/L2), RMS	meters	1.2	1.2
	Horizontal position accuracy (SBAS), RMS ⁽¹⁾	meters	0.6	0.6
	Horizontal position accuracy (DGPS), RMS	meters	n/a	0.4
	Horizontal position accuracy (TerraStar-L) ⁽²⁾	meters	n/a	0.4
	Horizontal position accuracy (TerraStar-C PRO) ⁽²⁾	meters	n/a	0.025
	Horizontal position accuracy (TerraStar-X) ⁽²⁾	meters	n/a	0.02
	Horizontal position accuracy (post processing) ⁽³⁾	meters	0.005	0.005
	Horizontal position accuracy (RTK), RMS	meters	0.01 + 1 ppm CEP	0.01 + 1 ppm
	Vertical position accuracy (SP), RMS	meters	<2	<1
	Vertical position accuracy (RTK), RMS	meters	0.02 + 1 ppm CEP	0.02 + 1 ppm
Velocity accuracy, RMS	meters/sec	0.05	0.02	
PPS timestamps accuracy	nano sec	20	20	
	Heading	Units	INS-DL-OEM	INS-D-OEM
Orientation	Range	deg	0 to 360	0 to 360
	Static Accuracy ⁽⁴⁾	deg RMS, 1σ	0.4 (1 meter base line)	0.15 (1 meter base line)
	Dynamic accuracy (GNSS) ⁽⁷⁾	deg RMS, 1σ	0.2 (2 meters baseline)	0.08 (2 meters baseline)
	Post processing accuracy ⁽³⁾	deg RMS, 1σ	0.1	0.03
	Pitch and Roll	Units	INS-DL-OEM	INS-D-OEM
	Range: Pitch, Roll	deg	±90, ±180	±90, ±180
	Angular Resolution	deg	0.01	0.01
	Static Accuracy in whole Temperature Range	deg	0.08	0.05
	Dynamic Accuracy ⁽⁷⁾	deg RMS	0.04	0.03
	Post processing accuracy ⁽³⁾	deg RMS	0.01	0.006
	GNSS receiver	Units	uBlox	NovAtel
GNSS	Number of GNSS Antennas		Dual	Dual
	Supported GNSS signals & corrections (optional)		GPS L1C/A L2C, GLO L1OF L2OF, GAL E1B/C E5b, BDS B1I B2I, QZSS L1C/A L2C SBAS L1C/A: WAAS, EGNOS, MSAS, GAGAN	GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BeiDou B1I, B1C, B2I, B2a, B3I; Galileo E1, E5 AltBOC, E5a, E5b, E6; NavIC (IRNSS) L5; SBAS L1, L5; QZSS L1 C/A, L1C, L2C, L5, L6; L-Band up to 5 channels; DGPS;
	Channel configuration ⁽⁵⁾		184 channels – F9 engine	555 Channels
	GNSS Positions data rate ⁽⁶⁾	Hz	10, 20 ⁽¹⁰⁾	Up to 100
	RTK corrections		RTCM 3	RTCM 2.1/2.3/3.0/3.1
	GNSS Measurements (raw) data rate	Hz	10, 20 ⁽¹⁰⁾	Up to 100
	Velocity accuracy, RMS	meters/sec	0.05	<0.03
	Initialization time	Sec	<29 (cold start), <1 (hot start)	39 (cold start), 20 (hot start)
Time accuracy (clock drift) ⁽⁸⁾	nano sec	30	20	
	Gyroscopes	Units	INS-DL-OEM	INS-D-OEM
IMU	Type		Industrial-grade	Tactical-grade
	Measurement range	deg/sec	±450 / ±950 / ±2000	±450 / ±950 / ±2000
	Bias in-run stability (RMS, Allan Variance)	deg/hr	3	1
	Bias error over temperature range (RMS)	deg/hr	<50	<30
	Angular Random Walk	deg/√hr	<0.3	<0.2
	Accelerometers	Units	INS-DL-OEM	INS-D-OEM
	Type		Industrial-grade	Tactical-grade
	Measurement range	g	±8 g ±15 g ±40 g	±8 g ±15 g ±40 g
	Bias in-run stability (RMS, Allan Variance)	mg	0.01 0.03 0.05	0.005 0.02 0.03
	Bias error over temperature range (RMS)	mg	0.7 1.1 1.5	0.5 0.7 1.2
Bias one-year repeatability	mg	1.5 2.0 2.5	1.0 1.3 1.5	
Velocity Random Walk	m/s/√hr	0.02 0.045 0.06	0.015 0.035 0.045	
	Environment	Units	INS-DL-OEM	INS-D-OEM
Electrical and Physical	Operating temperature	deg C	-40 to +75	-40 to +75
	Storage temperature	deg C	-50 to +85	-50 to +85
	MTBF	hours	55,500	55,500
	Electrical	Units	INS-DL-OEM	INS-D-OEM
	Supply voltage	V DC	9 - 36	9 - 36
	Power consumption	Watts	5 (6 with data logger)	5 (6 with data logger)
	Output Interface (options)	-	RS-232 or RS-422, CAN Ethernet (optional)	RS-232 or RS-422, CAN Ethernet (optional)
	Output data format	-	Binary, NMEA 0183 ASCII	Binary, NMEA 0183 ASCII
	Physical	Units	INS-DL-OEM	INS-D-OEM
	Size ⁽⁹⁾	mm	85.5 x 47.7 x 40	85.5 x 47.7 x 40.2
Weight ⁽⁹⁾	gram	174 (184)	174 (184)	

⁽¹⁾ GPS only; ⁽²⁾ Requires a subscription to a TerraStar data service; ⁽³⁾ RMS, incremental error growth from steady state accuracy. Post-processing results using third party software; ⁽⁴⁾ 2 meters base line between two GNSS antennas; ⁽⁵⁾ tracks up to 60 L1/L2 satellites; ⁽⁶⁾ 50 Hz while tracking up to 20 satellites. 20 Hz position update rate for Basic model of INS; ⁽⁷⁾ dynamic accuracy may depend on type of motion; ⁽⁸⁾ time accuracy does not include biases due to RF or antenna delay; ⁽⁹⁾ Weight and size are PN dependent. Customers should obtain the most recent 2D/3D files before designing any interface hardware. In bracket shown weight for a device in standard configuration with internal datalogger; ⁽¹⁰⁾ if tracking GPS only.

INS-D-OEM mechanical interface drawing (standard configuration)



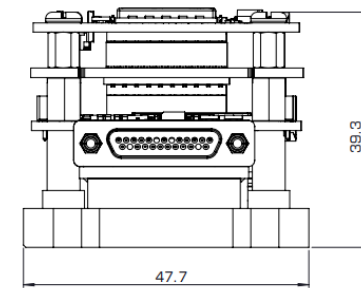
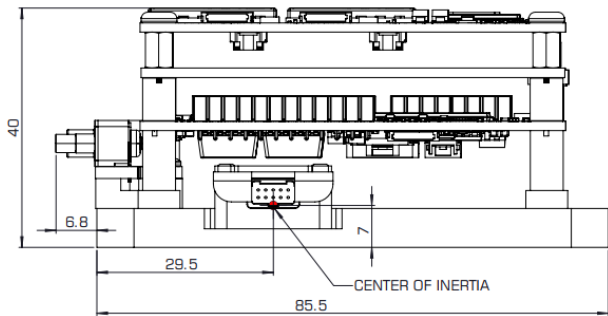
Device side: 25-pin connector
MDSM-25PE-Z10-VR17



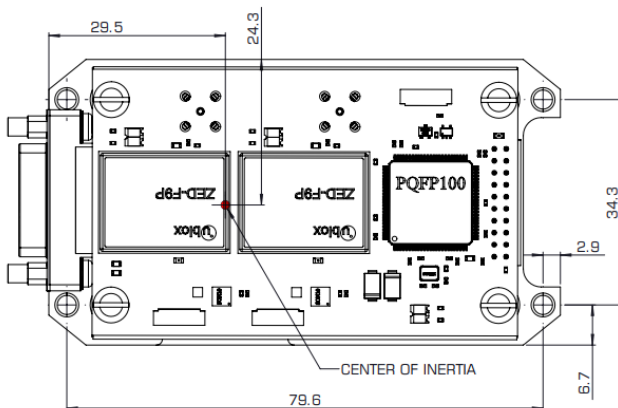
Notes:

1. All dimensions are in millimeters.
2. All dimensions within this drawing are subject to change without notice.
3. Weight and size are PN dependent. Customers should obtain the most recent 2D/3D files before designing any interface hardware.
4. Please contact Inertial Labs, Inc. if you need the INS unit to be delivered in a custom configuration with customized connector and output data.

INS-DL-OEM mechanical interface drawing (standard configuration)



Device side: 25-pin connector
MDSM-25PE-Z10-VR17



Notes:

1. All dimensions are in millimeters.
2. All dimensions within this drawing are subject to change without notice.
3. Weight and size are PN dependent. Customers should obtain the most recent 2D/3D files before designing any interface hardware.
4. Please contact Inertial Labs, Inc. if you need the INS unit to be delivered in a custom configuration with customized connector and output data.

Product Code Structure:

Model	Gyroscope	Accel	Calibration	Connector	SAMC	Encoder	Data Logger	GNSS receiver	Version	Interface
INS-D-OEM	G450	A8	TGA	C4	SAMC (option)	E (option)	S64	O7720	VD4	1
	G950	A15	TMGA (Option)	C6				ZD9P	VD42	2
	G2000	A40		C8				WOR	VD43	3
									VD44	4
									VD49	5
									VD9	11
										22
										145
										125
										245

Model	Gyroscope	Accel	Calibration	Connector	SAMC	Encoder	Data Logger	GNSS receiver	Version	Interface
INS-DL-OEM	G450	A8	TGA	C4	SAMC (option)	E (option)	S64	B482 (Obsolete)	VD9	1
	G950	A15	TMGA (Option)	C6				ZD9P		2
	G2000	A40		C8				WOR		3
										4
										5
										11
										22
										145
										125
										245

Product code details:

- INS-D-OEM: Dual Antenna GPS-Aided Inertial Navigation System
- INS-DL-OEM: Low cost Dual Antenna GPS-Aided Inertial Navigation System
- G450: Gyroscopes measurement range = ± 450 deg/sec
- G950: Gyroscopes measurement range = ± 950 deg/sec
- G2000: Gyroscopes measurement range = ± 2000 deg/sec
- A8: Accelerometers measurement range = ± 8 g \rightarrow recommended for applications with low level of operational vibrations
- A15: Accelerometers measurement range ± 15 g \rightarrow recommended for applications with medium level of operational vibrations
- A40: Accelerometers measurement range ± 40 g \rightarrow recommended for high dynamic applications or/and with high level of vibration
- TGA: Gyroscopes and Accelerometers
- TMGA: Magnetometers, Gyroscopes and Accelerometers
- C4: Aluminum Base Plate - 26 pin header and ribbon cable (20021121-00026T4LF by Amphenol) (with available interfaces of: RS-232, RS-422, Ethernet and CAN)
- C6: Aluminum Base Plate - 14 pin screw-lock connector (M80-5401442 by Harwin) (with available interfaces of: RS-232 and CAN, RS-422 and CAN, or Ethernet and CAN)
- C8: Aluminum Base Plate - 25-pin micro D-SUB connector with screw lock (MDSM-25PE-Z10-VR17 by ITT Cannon) (with available interfaces of: RS-232, RS-422, Ethernet and CAN)
- SAMC: support of external Stand Alone Magnetic Compass (for RS-232; or RS-422; or RS-232 & RS-422 interfaces)
- E: Encoder support
- S64: 64GB embedded Data Logger (optional)
- O7720: Novatel OEM7720 dual antenna GNSS receiver (INS-D-OEM only)
- B482: Inertial Labs B482 dual antenna GNSS receiver (INS-DL-OEM only) **OBSELETE**
- ZD9P: Dual ZED-F9P, Dual-Frequency, Multi-Constellation, RTK Capable GNSS Receiver
- WOR: without GNSS receiver
- VD4: GPS L1/L2, Dual antenna Heading, SBAS, DGPS, 20 Hz positions (NovAtel Dual Antenna GNSS Receiver only)
- VD42: GPS L1/L2, GLONASS L1/L2, Dual GNSS Heading, SBAS, DGPS, RTK, 20 Hz measurements, 20 Hz positions (NovAtel Dual Antenna GNSS Receiver only)
- VD43: GPS L1/L2, GLONASS L1/L2, Dual antenna Heading, SBAS, DGPS, 20 Hz positions (NovAtel Dual Antenna GNSS Receiver only)
- VD44: GPS L1/L2, GLONASS L1/L2, GALILEO E1B/C E5b Dual antenna Heading, SBAS, DGPS, 20 Hz positions (NovAtel Dual Antenna GNSS Receiver only)
- VD49: GPS L1/L2, GLONASS L1/L2, NavIC (IRNSS), Dual antenna Heading, SBAS, DGPS, 20 Hz positions; 20 Hz GNSS measurements (NovAtel Dual Antenna GNSS Receiver only)
- VD9: GPS L1/L2, GLONASS L1/L2, BEIDOU B1/B2, GALILEO E1/E5, QZSS L1/L5, DGPS, RTK, Dual GNSS Heading, GNSS measurements, GNSS positions (Dual Antenna GNSS Receiver only)
- .1: RS-232 interface
- .2: RS-422 interface
- .3: RS-485 interface (temporary is not available)
- .4: CAN interface
- .5: Ethernet interface
- .11: two RS-232 interfaces (only available for C4 and C8 connectors)
- .22: two RS-422 interfaces (only available for C4 and C8 connectors)
- .145: RS-232, CAN and Ethernet interfaces (with optional Encoder support) (only available for C4 and C8 connectors)
- .125: RS-232, RS-422 and Ethernet interfaces (without optional Encoder support) (only available for C8 connectors)
- .245: RS-422, CAN and Ethernet interfaces (without Encoder support) (only available for C4 and C8 connectors)