

Installation Planning Guide EZDP-2148 Rev E Electrical Signature Analysis

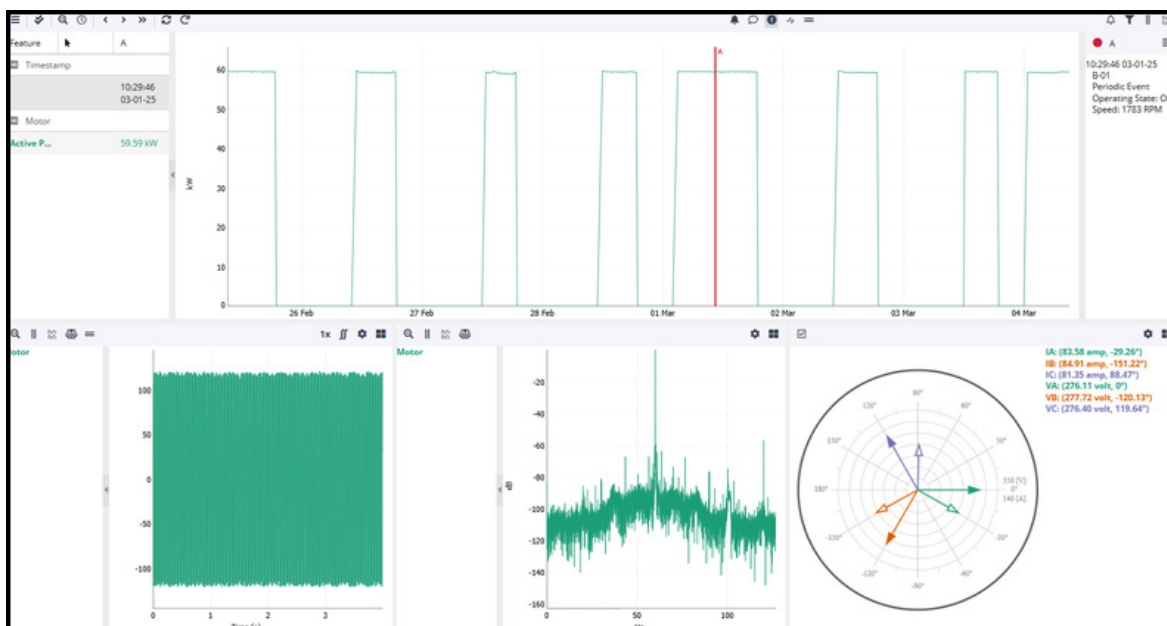


Table of Contents

Legal Information	1
Limited Warranty	1
Copyright	2
Trademarks	2
U.S. Government Use and Rights	2
Patents	3
Safety Information	4
1. System Overview	7
1.1. Electrical Signature Analysis Overview	7
1.2. InsightCM Features	8
2. IT System Requirements	9
2.1. Overall Architecture	9
2.2. Server Hardware Requirements	9
2.3. Networking Requirements	10
3. Physical Installation Overview	11
3.1. Equipment List	11
3.2. Installation	11
3.2.1. Conduit Layout	12
3.2.2. Conduit and Strut Channel Recommendations	14
3.2.3. Enclosure Specifications	15
3.3. Power Requirements	17
3.3.1. AC Power Supply Requirements	17
3.3.2. AC Power Specifications	17
3.4. Environmental Specifications	17
3.5. Product Certifications	17
3.6. Instrumentation	19
3.6.1. Current Sensors	20
3.6.2. Potential Measurements	21
3.7. Integration and Infrastructure	21
4. Configuring InsightCM for ESA Assets	22
4.1. Motor Nameplate Information	22
4.2. Build Asset Tree in InsightCM	23
4.3. Configure Devices in InsightCM	23
4.4. Commission Motors Using the Phasor Diagram	23
5. Glossary	25

Legal Information

Limited Warranty

This document is provided 'as is' and is subject to being changed, without notice, in future editions. Cutsforth reviews this document carefully for technical accuracy; however, CUTSFORTH MAKES NO EXPRESS OR IMPLIED WARRANTY AS TO THE ACCURACY OF THE INFORMATION WITHIN THIS MANUAL AS IT RELATES TO ANY SPECIFIC INSTALLATION. THE CUSTOMER IS RESPONSIBLE FOR VERIFYING INSTALLATION AND OPERATING CONDITIONS AT EACH INSTALLATION LOCATION AND FOR EACH ASSET AND EQUIPMENT TYPE ON WHICH THE PRODUCTS ARE INSTALLED OR USED. Cutsforth warrants that its hardware products will be free of defects in materials and workmanship that cause the product to fail to substantially conform to the applicable Cutsforth published specifications for one (1) year from the date of invoice.

For a period of ninety (90) days from the date of invoice, Cutsforth warrants that its software products will perform substantially in accordance with the applicable documentation provided with the software. Software or services provided on a subscription, hosted, or software-as-a-service basis are governed by the applicable license, subscription, or services agreement, and the warranty terms of that agreement control for those offerings. If Cutsforth receives notice of a defect or non-conformance during the applicable warranty period, Cutsforth will, in its discretion: (i) repair or replace the affected product, or (ii) refund the fees paid for the affected product. Repaired or replaced hardware will be warranted for the remainder of the original warranty period or ninety (90) days, whichever is longer. If Cutsforth elects to repair or replace the product, Cutsforth may use new or refurbished parts or products that are equivalent to new in performance and reliability and are at least functionally equivalent to the original part or product. You must obtain an RMA number from Cutsforth before returning any product to Cutsforth. Cutsforth reserves the right to charge a fee for examining and testing hardware not covered by the Limited Warranty.

This Limited Warranty does not apply if the defect of the product resulted from improper or inadequate maintenance, installation, repair, or calibration performed by a party other than Cutsforth; unauthorized modification; improper environment; use of an improper hardware or software key; improper use or operation outside of the specification for the product; improper voltages; accident, abuse, or neglect; or a hazard such as lightning, flood, or other act of nature.

If Customer and Cutsforth have entered into a separate signed written agreement governing the products or services, the terms of that agreement control to the extent they conflict with this statement.

THE REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND THE CUSTOMER'S SOLE REMEDIES, AND SHALL APPLY EVEN IF SUCH REMEDIES FAIL OF THEIR ESSENTIAL PURPOSE.

WARNING REGARDING USE OF CUTSFORTH PRODUCTS: CUSTOMER IS ULTIMATELY RESPONSIBLE FOR VERIFYING AND VALIDATING THE SUITABILITY AND RELIABILITY OF THE PRODUCTS WHENEVER THE PRODUCTS ARE INCORPORATED IN THEIR SYSTEM OR APPLICATION, INCLUDING THE APPROPRIATE DESIGN, PROCESS, AND SAFETY LEVEL OF SUCH SYSTEM OR APPLICATION. PRODUCTS ARE NOT DESIGNED, MANUFACTURED, OR TESTED FOR USE IN LIFE OR SAFETY CRITICAL SYSTEMS, OR ANY OTHER APPLICATION IN WHICH THE FAILURE OF THE PRODUCT

OR SERVICE COULD LEAD TO DEATH, PERSONAL INJURY, SEVERE PROPERTY DAMAGE OR ENVIRONMENTAL HARM (COLLECTIVELY, "HIGH-RISK USES"). CUTSFORTH PRODUCTS ARE MONITORING, MEASUREMENT, AND DIAGNOSTIC TOOLS; THEY ARE NOT PROTECTIVE DEVICES OR SAFETY SYSTEMS, AND THEY ARE NOT A SUBSTITUTE FOR CUSTOMER'S OWN INSPECTION, MAINTENANCE, AND ENGINEERING JUDGMENT. CUTSFORTH DOES NOT WARRANT THAT THE PRODUCTS WILL DETECT, PREDICT, OR PREVENT ANY PARTICULAR FAULT, CONDITION, OR FAILURE. FURTHER, PRUDENT STEPS MUST BE TAKEN TO PROTECT AGAINST FAILURES, INCLUDING PROVIDING BACK-UP AND SHUT-DOWN MECHANISMS. CUTSFORTH EXPRESSLY DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY OF FITNESS OF THE PRODUCTS OR SERVICES FOR HIGH-RISK USES.

TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, CUTSFORTH DOES NOT WARRANT, GUARANTEE, OR MAKE ANY REPRESENTATIONS REGARDING THE USE OF OR THE RESULTS OF THE USE OF THE PRODUCTS — INCLUDING ANY DATA, MEASUREMENTS, ALERTS, ANALYTICS, OR REPORTS GENERATED BY THE PRODUCTS — IN TERMS OF CORRECTNESS, ACCURACY, RELIABILITY, COMPLETENESS, OR OTHERWISE. CUTSFORTH DOES NOT WARRANT THAT THE OPERATION OF THE PRODUCTS WILL BE UNINTERRUPTED OR ERROR FREE. INCIDENTAL AND CONSEQUENTIAL DAMAGES, INCLUDING LOSS OF USE, LOSS OF DATA, AND LOSS OF PROFITS, ARE SPECIFICALLY EXCLUDED FROM THIS WARRANTY; THE MAXIMUM VALUE OF A WARRANTY CLAIM CANNOT EXCEED THE ORIGINAL VALUE OF THE AFFECTED ASSEMBLY OR COMPONENT. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF IMPLIED WARRANTIES OR OF INCIDENTAL OR CONSEQUENTIAL DAMAGES; IN THOSE JURISDICTIONS, THE ABOVE EXCLUSIONS AND LIMITATIONS APPLY TO THE MAXIMUM EXTENT PERMITTED BY LAW.

Copyright

Under copyright law, this publication may not be reproduced or transmitted in any form, electronic or mechanical, including photocopying, recording, storing in an information retrieval system, or translating, in whole or in part, without the prior written consent of Cutsforth. Cutsforth respects the intellectual property of others, and we ask our users to do the same. Cutsforth software is protected by copyright and other intellectual property laws. Cutsforth software is licensed, not sold, and may be installed and used only in accordance with the applicable license or subscription terms, including any restriction to the hardware or systems for which it was licensed. Reproduction of software or written materials is prohibited unless Customer has obtained a license for that express purpose.

Trademarks

Cutsforth and the Cutsforth logo are trademarks of Cutsforth, Inc. All other trademarks are the property of their respective owners.

U.S. Government Use and Rights

Cutsforth products are commercial products, and Cutsforth services are commercial services, as those terms are defined in FAR 2.101. Cutsforth hardware products, where offered without modification and sold in substantial quantities in the commercial marketplace, are commercially available off-the-shelf (COTS) items as defined in FAR 2.101. Cutsforth products were developed exclusively at private expense.

Cutsforth software is commercial computer software, and the accompanying documentation is commercial computer software documentation. If the software or documentation is acquired by or on

behalf of the U.S. Government or a U.S. Government prime contractor or subcontractor (at any tier), the Government's rights in the software and documentation are only those set forth in the applicable Cutsforth license or subscription agreement, in accordance with FAR 12.212 and DFARS 227.7202-1 through 227.7202-4, or the successor provisions thereto. Technical data provided with Cutsforth products is furnished with limited rights in accordance with DFARS 252.227-7015 where applicable.

Cutsforth products and hosted services are not authorized for the processing or storage of classified information. Unless expressly agreed by Cutsforth in a signed writing, Cutsforth products and hosted services are not intended or authorized for the processing or storage of Controlled Unclassified Information (CUI). Customer is responsible for ensuring that information provided to or generated within Cutsforth products and services complies with the information-security, export-control, and critical infrastructure information requirements applicable to Customer, including, where applicable, requirements governing CUI and Critical Energy/Electric Infrastructure Information (CEII).

Patents

Please send patent information requests to patents@cutsforth.com.

Safety Information

Safety Information [English]

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.



Please note that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Safety Conventions



NOTE:

Additional information.



ELECTRICAL DANGER

Indicates an action or specific equipment area that can result in personal injury or death from an electrical hazard if proper precautions are not taken.



CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury or equipment damage.



WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.



ROTATING PART CAUTION

Indicates possible injury from rotating parts.



DANGER

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

General Safety Instructions



ELECTRICAL DANGER

Only qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid injury should work with Cutsforth products. Among the many considerations are the following:

- Avoid contact with energized circuits.
- Avoid contact with rotating parts.
- Never install any component that appears not to be functioning in a normal manner.



ROTATING PART CAUTION

High-voltage and rotating parts can cause serious or fatal injury. Installation, operation, and maintenance of this product must be performed only by qualified personnel, in accordance with all applicable safety regulations and guidelines.



LIFTING EQUIPMENT

For configurations that weigh more than 18 kg (40 lbs.), please utilize team lifting techniques to lift and move the equipment, including lifting with the legs, and avoid twisting while moving the equipment.

Consignes de Sécurité [Français]

Les informations qui suivent sont essentielles afin d'assurer la sécurité de l'utilisateur lors de l'installation et de l'opération de l'équipement. Assurez-vous de bien lire et de comprendre tous les avertissements et mises en garde qui suivent.



Veuillez noter que si l'équipement est utilisé d'une manière non spécifiée par le fabricant, la protection assurée par l'équipement peut être compromise.

Conventions de Sécurité



NOTE:

Informations supplémentaires.



RISQUES DE CHOC ÉLECTRIQUE

Indique que l'action ou la partie de l'équipement concernée peut mener à des blessures par électrisation ou à la mort par électrocution si les précautions adéquates ne sont pas prises.



MISE EN GARDE

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures mineures à modérées ou à des dommages matériels.



AVERTISSEMENT

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures sévères ou à la mort.



MISE EN GARDE : PIÈCE ROTATIVE

Indique la présence de pièces d'équipement rotatives pouvant causer des blessures.



DANGER

Indique la présence d'une situation dangereuse qui, si elle n'est pas évitée, pourrait mener à des blessures sévères ou à la mort.

Consignes de Sécurité Générales



RISQUES DE CHOC ÉLECTRIQUE

L'utilisation des produits Cutsforth n'est recommandée qu'aux professionnels qualifiés qui savent comment reconnaître la présence de risques de choc électrique ainsi que les consignes de sécurité à suivre pour éviter les blessures liées à ces risques. Lesdites consignes de sécurité incluent, sans s'y limiter :

- Éviter tout contact avec des circuits alimentés;
- Éviter tout contact avec des pièces d'équipement rotatives;
- Ne jamais installer de composante ne paraissant pas fonctionner normalement;



MISE EN GARDE : PIÈCE ROTATIVE

Les pièces d'équipement rotatives et sous haute tension peuvent causer des blessures sévères ou fatales. L'installation, l'opération et la manutention de ce produit ne doivent être faites que par des professionnels qualifiés et en respectant toutes les règles et consignes de sécurité applicables.



ÉQUIPEMENT DE LEVAGE

Pour les configurations pesant plus de 18 kg (40 lb), veuillez recourir à des techniques de levage en équipe pour soulever et déplacer l'équipement — notamment en sollicitant les jambes — et évitez toute torsion du corps lors du déplacement.

1. System Overview

This manual is a guide for planning the installation of the Electrical Signature Analysis system.



This manual does not cover all details or variations in equipment, nor does it consider every possible contingency for installation, operation, or maintenance. If you have questions or concerns that are not addressed in this manual, contact Cutsforth Engineering Support.

1.1. Electrical Signature Analysis Overview

Cutsforth's Electrical Signature Analysis (ESA) is a permanently installed, online, motor monitoring system that uses voltage and current signals to identify motor faults. The ESA toolkit for InsightCM™ computes features specific to electrical data and motors beyond phasor and waveform analysis. ESA systems can monitor up to nine motors on a single voltage bus with one acquisition device. Installation near Motor Control Centers (MCCs) or switchgear minimizes cable lengths and installation costs.

Common failure modes managed with ESA:

- Rotor bar damage
- Misalignment
- Eccentricity
- Mechanical looseness
- Stator faults
- Bearing faults
- Power Quality Issues

Leverage new or existing equipment

Cutsforth's ESA system can make use of protective relay current transformers (current sensors) and potential transformers (PTs) to simplify installation and necessary signal conditioning. You can also take advantage of existing infrastructure to minimize installation and sensing costs. If current sensors and PTs are not present, you make measurements directly with properly sized instrumentation which can integrate into the ESA platform.

ESA viewers in InsightCM:

- Trend
- Waveform
- Spectrum
- High resolution spectrum

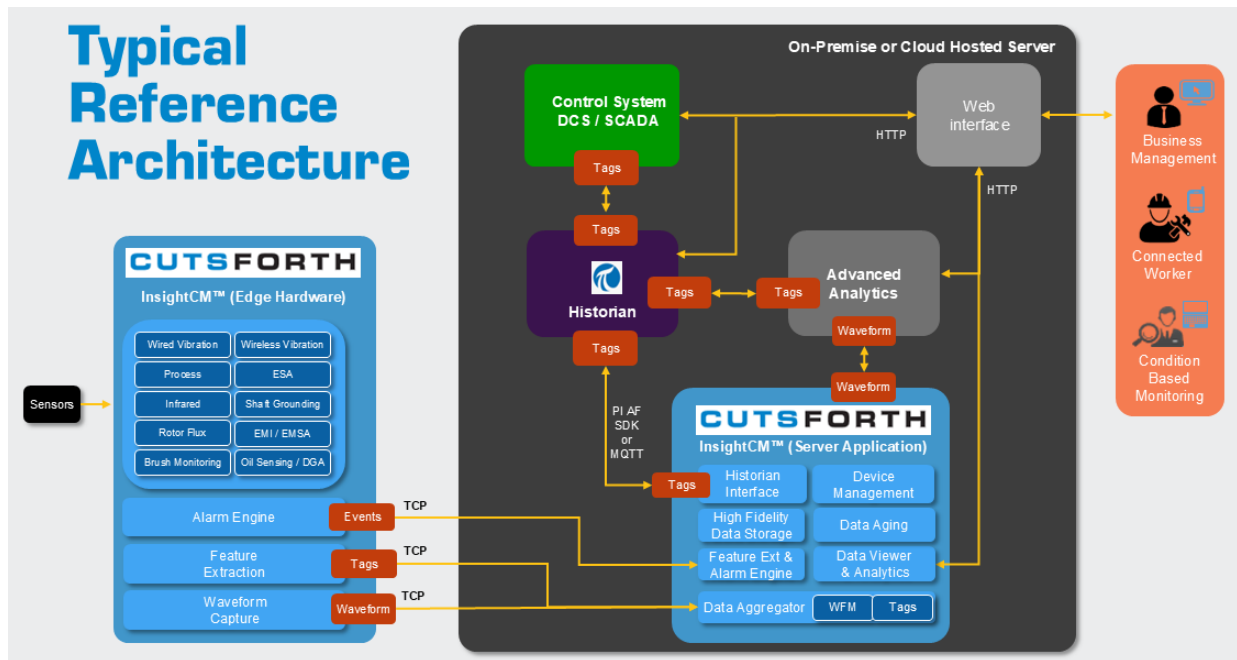
- High resolution spectrum
- Phasor diagram
- Envelope (amplitude demodulation)
- Park Clarke

1.2. InsightCM Features

InsightCM can extract a multitude of features from hardware installed in the field. The calculated feature data from InsightCM can be transmitted to plant historians for integration into advanced pattern recognition (APR) models or other advanced machine learning platforms. For more information on InsightCM features, visit the InsightCM user manual on the Cutsforth Support webpage at <https://support.cutsforth.com>.

2. IT System Requirements

2.1. Overall Architecture



2.2. Server Hardware Requirements



InsightCM requires a dedicated server. If NI SystemLink is present on the target machine (for example, from a previous NI deployment), install InsightCM on a different server, as the two products cannot share a machine.



Cutsforth recommends using solid state drives to improve disk throughput.

Proof of Concept	Standard Deployment	Enterprise
- Windows 11, 64-bit Professional 2.2 GHz, 4-core processor 16 GB RAM - One physical hard drive for OS, program installation, and storing data files—At least 500 GB disk space	- Windows Server 2016, 2019, 2022, or 2025 3 GHz, 16-core processor 32 GB RAM - Two physical hard drives: For OS and program installation—At least 250 GB disk space For storing data files—At least 2 TB disk space	Contact your Account Manager or put in a request here: cutsforth.com/contact-us/

2.3. Networking Requirements

A fast or gigabit Ethernet (100 Mbps or 1000 Mbps) local area network or business network connection is required between a PC/server running InsightCM and the data acquisition devices. It is also preferable for this PC/server to be connected through the network to the site data historian for ease of gathering process data.

3. Physical Installation Overview

3.1. Equipment List

To install the ESA Monitoring system, you need the equipment listed below. Some are provided by Cutsforth, and some are provided by the electrical contractor.

Equipment	Supplied by Cutsforth	Supplied by Electrical Contractor
Current Sensor	✓	
Controller – one or two of the following (depending on number of motors being monitored): - cRIO-9055 4-slot controller - cRIO-9058 8-slot controller	✓	
NI-9242 or NI-9244 voltage bus input card	✓	
NI-9239 Voltage Input Module for voltage output current sensor	✓	
NEMA 4X rated enclosure	✓	
Multi-paired, shielded, Tray Cable for PT and Current Sensor signal Inputs		✓
Conduit		✓
Ethernet cable for connection to server		✓
600 volt rated power cable		✓

Servicing Equipment

If fuses are part of the ESA system, they can be replaced with Eaton Bussman KTK-1 fuse or equivalent 1A, 600V, fast-acting cartridge style fuse.

3.2. Installation

This section provides step-by-step instructions for installing the ESA Monitoring System enclosure.

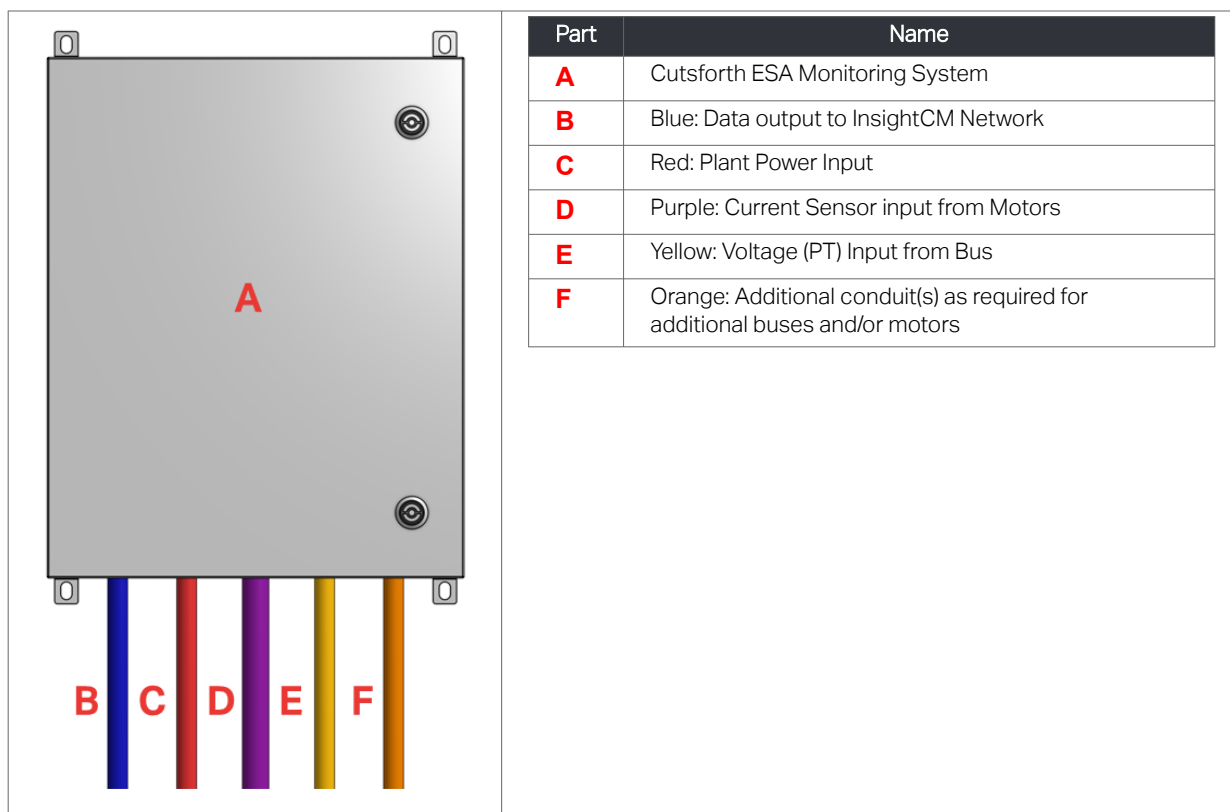
1. Mount the ESA System enclosure at the planned location.
2. Install the conduit between the ESA Monitoring System and each voltage bus pickup point.
3. Install the conduit between the ESA Monitoring System and each current sensor pickup point. Current sensor cables may be combined in conduit as long as it is appropriately sized. Current sensor cables should not be combined with PT cables.

4. Install the conduit for 120VAC power. Minimum circuit size: 20A 120VAC power supply free of non-linear loads. Consider a circuit with isolated ground.
5. Install the conduit and wire for data connection. Cutsforth recommends Cat6a or fiber connection (media converter required).
6. Connect protective earth conductor per local electrical codes.
7. Install wire for 120–240VAC supply per local electrical codes.
8. If required by local electrical codes, install an external switch or circuit breaker near the equipment. Ensure equipment is positioned so that it will not be difficult to operate the external disconnecting device.

3.2.1. Conduit Layout

Color on Diagram	Conduit Run Description	Conduit Trade Size*	Wire Description	Purpose	Max. Cable Length	Wire Supplied By
Blue	ESA Enclosure to InsightCM Server	3/4 in (2 cm)	Cat6a Cable or Fiber	Data to InsightCM Server	330 ft (100 m)	Plant Electrical Contractor
Red	Plant Power to ESA Enclosure	3/4 in (2 cm)	120VAC Power (20A dedicated circuit – preferably with isolated ground)	Power for the Monitoring System	N/A	Plant Electrical Contractor
Purple	Current Sensor Voltage Output to ESA Enclosure	Size dependent on cable type used and quantity. Follow NEC and site electrical specification for proper sizing.	Shielded Twisted Pair	Current Sensor Signal In	100 ft	Plant Electrical Contractor
Yellow	Voltage Bus Signals to ESA Enclosure	3/4 in (2 cm)	Shielded Twisted Pair	Voltage Bus Signal In	100 ft	Plant Electrical Contractor

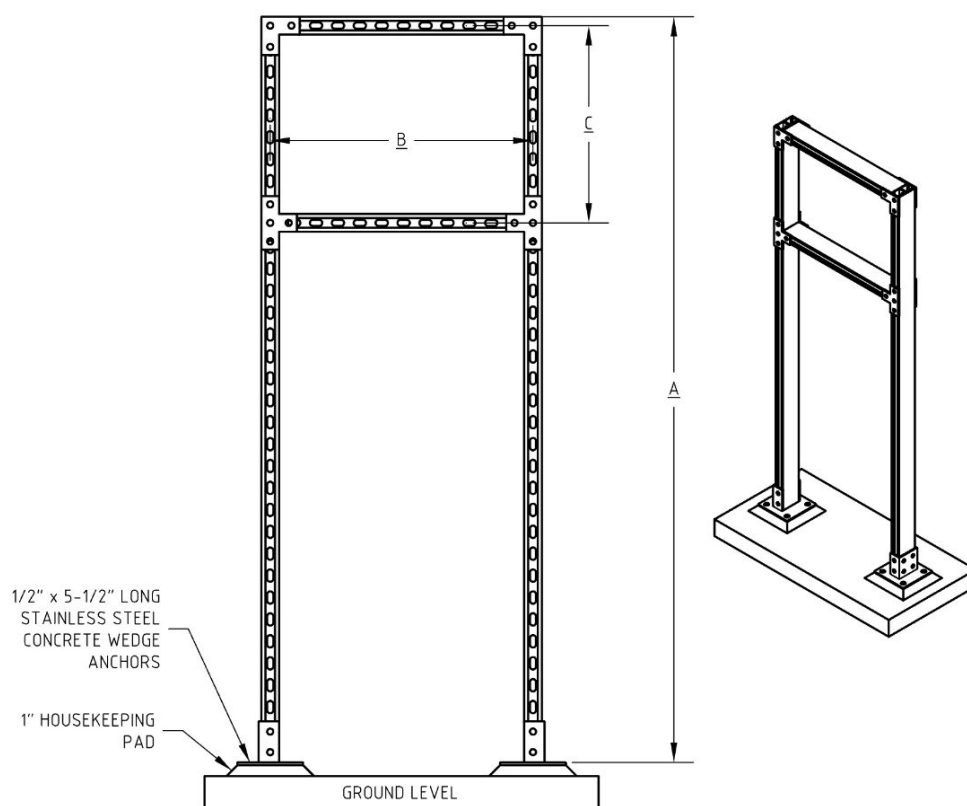
*Enclosures do not come with conduit holes pre-drilled. Conduit sizing and hole placement is customizable.



3.2.2. Conduit and Strut Channel Recommendations

Component	Standard Recommendation	Recommendation for High-Corrosion Environments
Conduit type	Galvanized rigid metal conduit (RMC)	Rigid Aluminum Conduit (RAC)
Conduit fittings type	Malleable, NEMA 4X rated or greater	Aluminum
Strut channel type	Hot dipped galvanized, back-to-back	316 Stainless steel
Mounting hardware	316 Stainless steel	316 Stainless steel
Liquid flexible metallic conduit	Type HCX	Type HCX

3.2.2.1. Recommended Strut Rack Design



A in. (mm)	B in. (mm)	C in. (mm)
68 (1730)	24 (610)	Refer to enclosure mounting feet dimensions

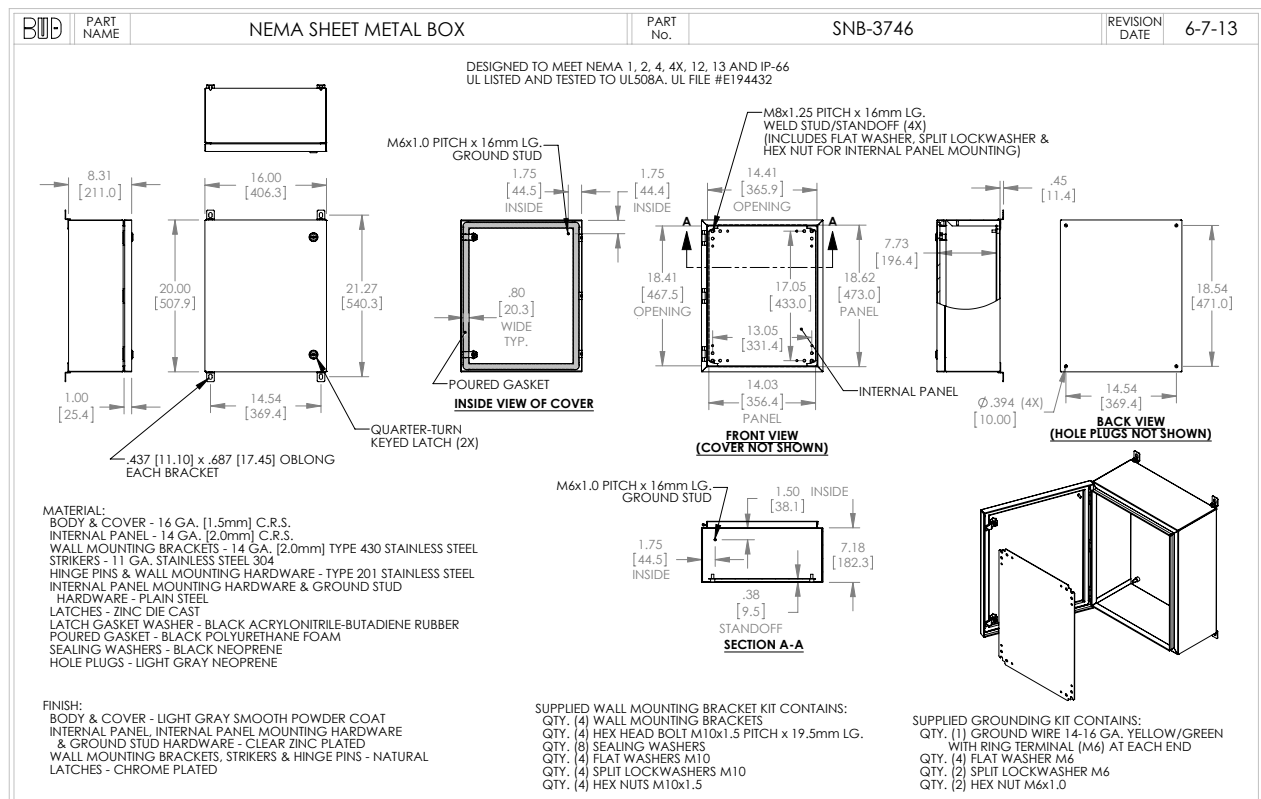
3.2.3. Enclosure Specifications

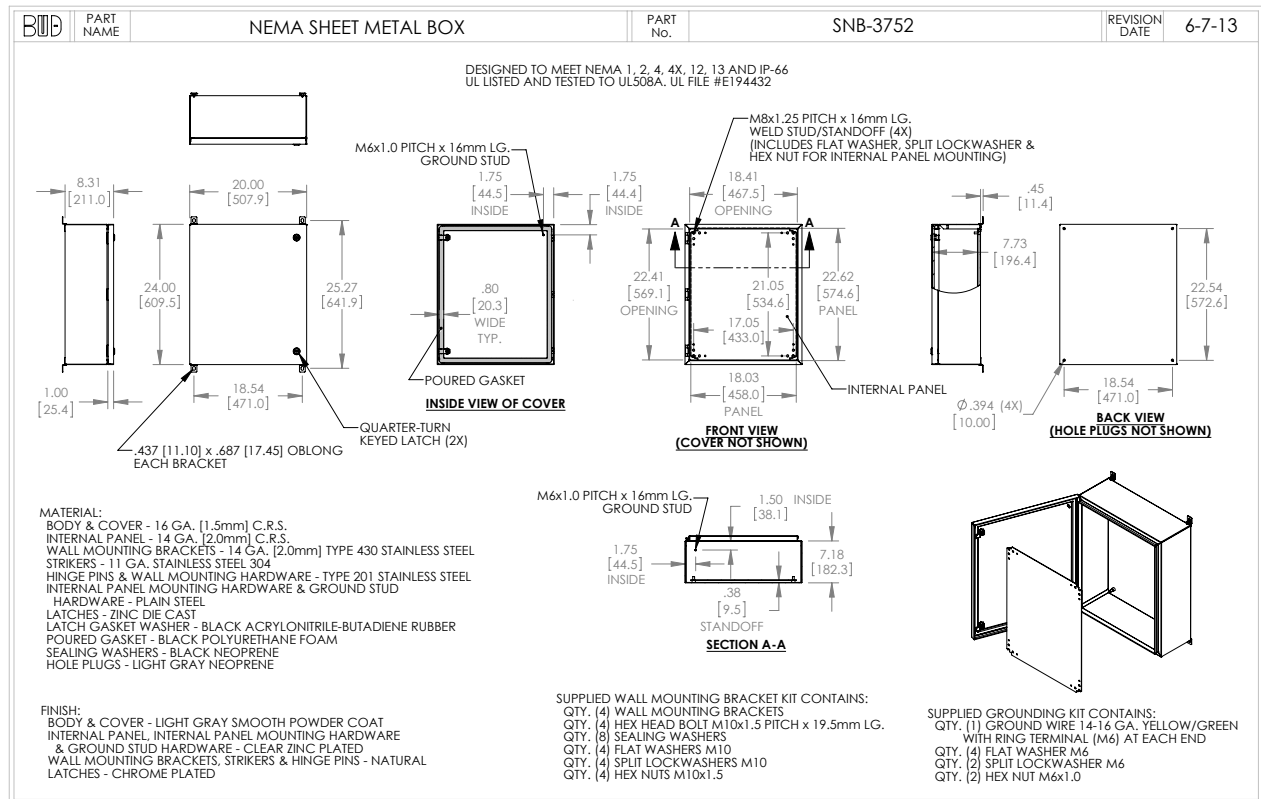
3.2.3.1. ESA System Enclosures



The specific enclosure used is determined by the space requirements of the requested product configuration.

Catalog Number	Dimensions (in. (mm))
SNB-3746	20.0 (508) x 16.0 (406) x 8.0 (203)
SNB-3752	24.0 (610) x 20.0 (508) x 8.0 (203)





Specifications:

- UL 508A Listed Type 1, 2, 4, 4X, 12, and 13 File No. E194432
- IP Rating: IP65 and IP66
- RoHS Compliant
- Powder Coated Steel



CLEANING THE ENCLOSURE

It is recommended to clean the exterior of the enclosure, as needed, to remove excess buildup of dust, debris, or other contamination. Ensure the enclosure door is shut while cleaning to prevent contact with internal components. Use a non-conductive, non-residue cleaner (e.g., 70% isopropyl alcohol & 30% water mixture) and a soft cloth that will not scratch the enclosure surface.

3.3. Power Requirements

3.3.1. AC Power Supply Requirements

Plant-supplied power source	120 V, 60 Hz AC or 240 V, 50 Hz
Circuit breaker	Internal 120 V, 5 A
Current draw under normal usage	Approximately 0.6 A

3.3.2. AC Power Specifications

Input Voltage Range	100 – 240VAC
Input Frequency Range	50 – 60Hz
Input Power Rating	150 W
Overvoltage Category	II; According to EN62368, EN61558, EN50178, EN60664-1, EN62477-1
Input Wire Connection Type	DIN, Screw-Down Terminal Block
Input Wire Size	26 – 10 AWG

3.4. Environmental Specifications

Storage Temperature	-40 °C to 85 °C (-40 °F to 185 °F)
Operating Temperature	-20 °C to 65 °C (-4 °F to 149 °F)
Storage Humidity	5% RH to 95% RH, non-condensing
Operating Humidity	10% RH to 90% RH, non-condensing
Maximum Altitude	2,000 m (6,500 ft)
Pollution Degree	2
Weight	15.88 – 27.22 kg (35 – 60 lbs.) depending on configuration
Indoor / Outdoor Use	Both

3.5. Product Certifications

Table 1. North America

Electromagnetic Compatibility (EMC)	Conforms to FCC 15.107 2026, Class A FCC 15.109 2026, Class A Certified to ICES-003 Issue 7 2020, Class A
Safety	Conforms to UL 508A and CSA C22.2 No. 286

Table 2. EU Directive Information – CE Compliance

Electromagnetic Compatibility (EMC) Directive 2014/30/EU	Tested to EN IEC 61326-1 2021, Class A
--	--

Table 3. UKCA

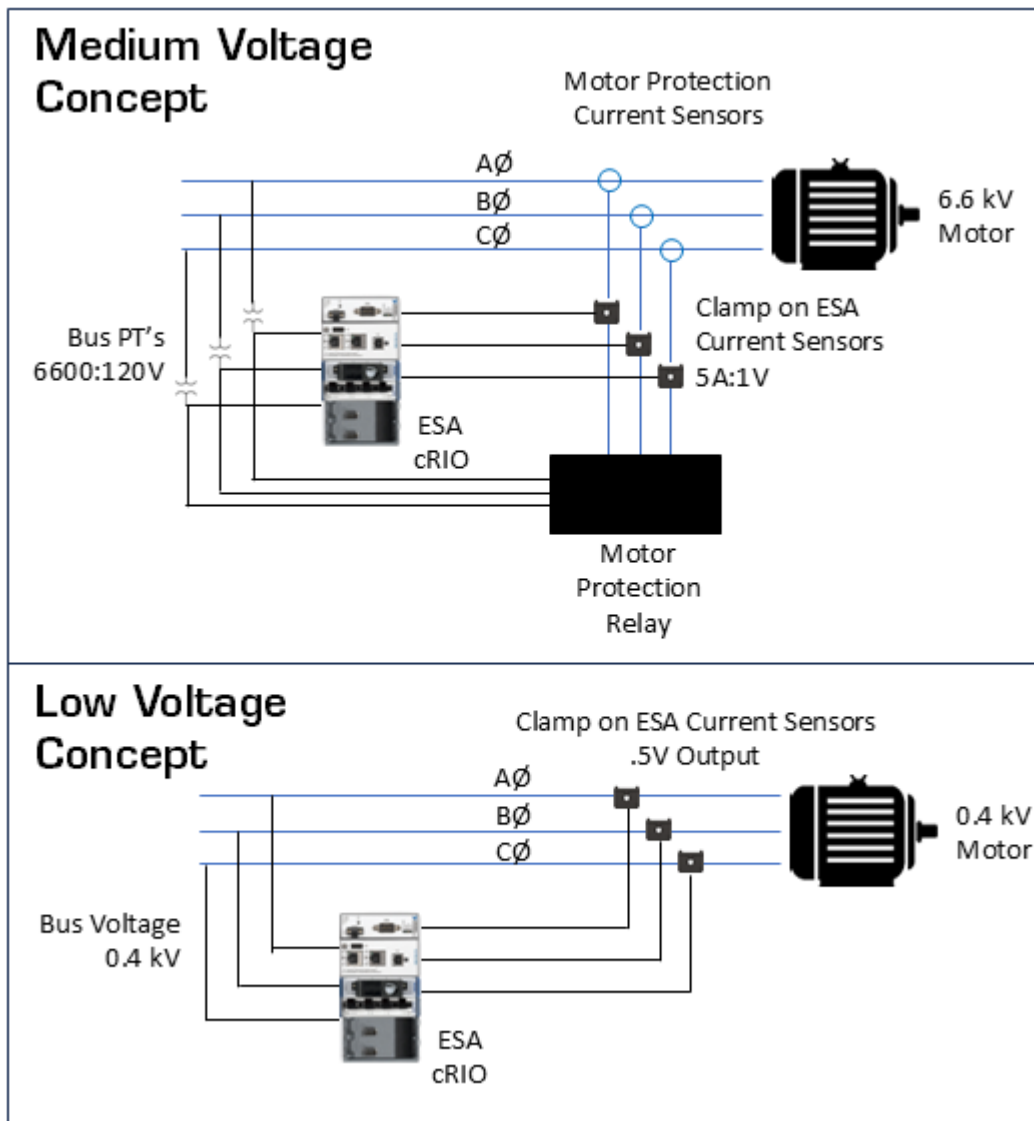
Electromagnetic Compatibility (EMC) 2016	Tested to EN 61326-1 2021, Class A
--	------------------------------------

WEEE Directive Statement

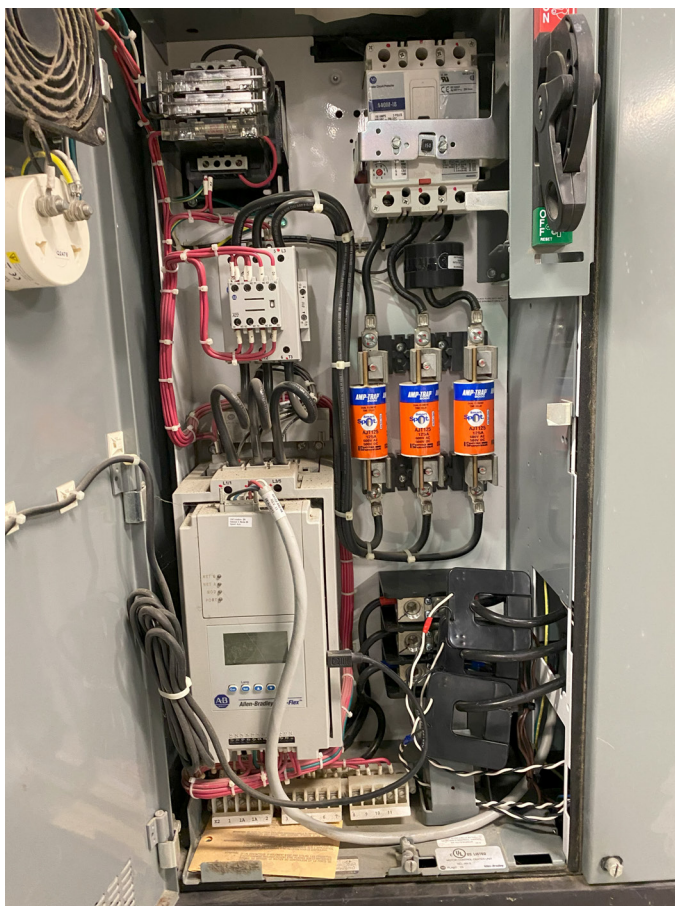
In accordance with Article 14 of Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), the following marking requirements apply:

- The directive applies to electrical and electronic equipment falling under Annex I, Category 9 of Directive 2012/19/EU.
- Products must include markings that clearly identify the producer and indicate that the equipment was placed on the market after 13 August 2005.
- The crossed-out wheeled bin symbol signifies that the equipment must not be disposed of with unsorted municipal waste. End users are required to follow applicable local recycling and disposal procedures for electrical and electronic equipment.
- The marking affixed to the product confirms that it falls within the scope of this directive.

3.6. Instrumentation



3.6.1. Current Sensors



3.6.2. Potential Measurements

The ESA system potential (voltage) measurements can be made by paralleling to an existing bus PT (typical in medium voltage systems) or paralleling directly from the bus (low voltage system).

Medium voltage connection points may be made from the load side of the existing PT fuses, existing relay test switches, or relay voltage inputs.

Low voltage connection points may be directly connected to the bus, auxiliary connection points on an MCC breaker, or existing motor test points.

It is important to specify the line-to-line voltage magnitude and configuration (delta/wye) when ordering your ESA monitoring equipment so the appropriate input module can be included in your build.

3.7. Integration and Infrastructure

The Cutsforth ESA Monitoring System is designed to be integrated into InsightCM™ software. For more information on InsightCM™, including specific server requirements, visit the InsightCM™ README on the Cutsforth Support webpage at <https://support.cutsforth.com>.

The plant must provide a PC or Server for InsightCM™ meeting the requirements listed at the above link. Cutsforth is not responsible for the configuration of server-side deployment. Ensure the plant's InsightCM™ server is set up and ready for communication to field equipment in advance of system commissioning by Cutsforth.

4. Configuring InsightCM for ESA Assets

4.1. Motor Nameplate Information

ESA requires certain motor nameplate information to be input into InsightCM in order for the analysis and calculations to take place:

- Load
- Load Unit (HP or KW)
- Nominal Frequency (50 or 60 Hz)
- Synchronous speed (RPM)
- Full load speed (RPM)
- Rated volts (Volts)
- Full load amps (Amps)
- Service Factor
- Power Factor
- Full Load Efficiency

These are optional Nameplate/ESA Property fields:

- Efficiency at 75% Load
- Efficiency at 50% Load
- Efficiency at 25% Load
- Number of Stator Slots
- Number of Pump Vanes / Fan Blades
- Number of Rotor Bars

The data above can be found in a number of different locations:

- Motor Nameplates
- Spare Motor Nameplate
- Motor/Pump Manuals
- Previous Test Reports
- CBM/PdM Databases/Reports
- Relay/Protection Documents
- Etc.

4.2. Build Asset Tree in InsightCM

Refer to the InsightCM Setup and Configuration manual on the Cutsforth Support webpage at <https://support.cutsforth.com> for instructions regarding how to build the InsightCM asset tree.

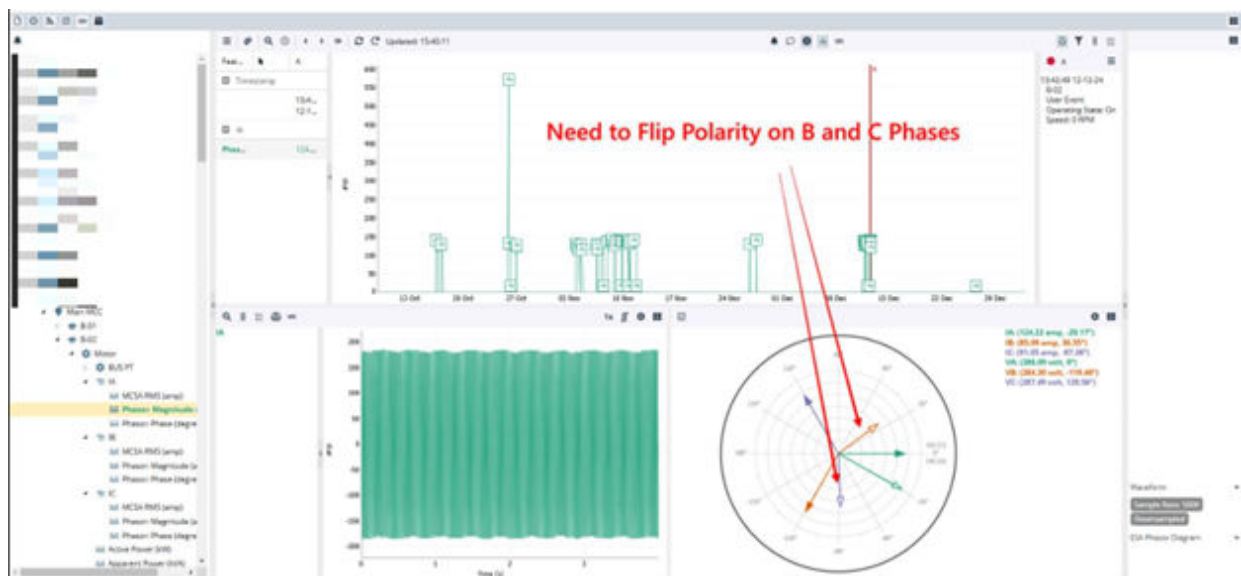
4.3. Configure Devices in InsightCM

Refer to the InsightCM Setup and Configuration manual on the Cutsforth Support webpage at <https://support.cutsforth.com> for instructions regarding how to configure devices in InsightCM.

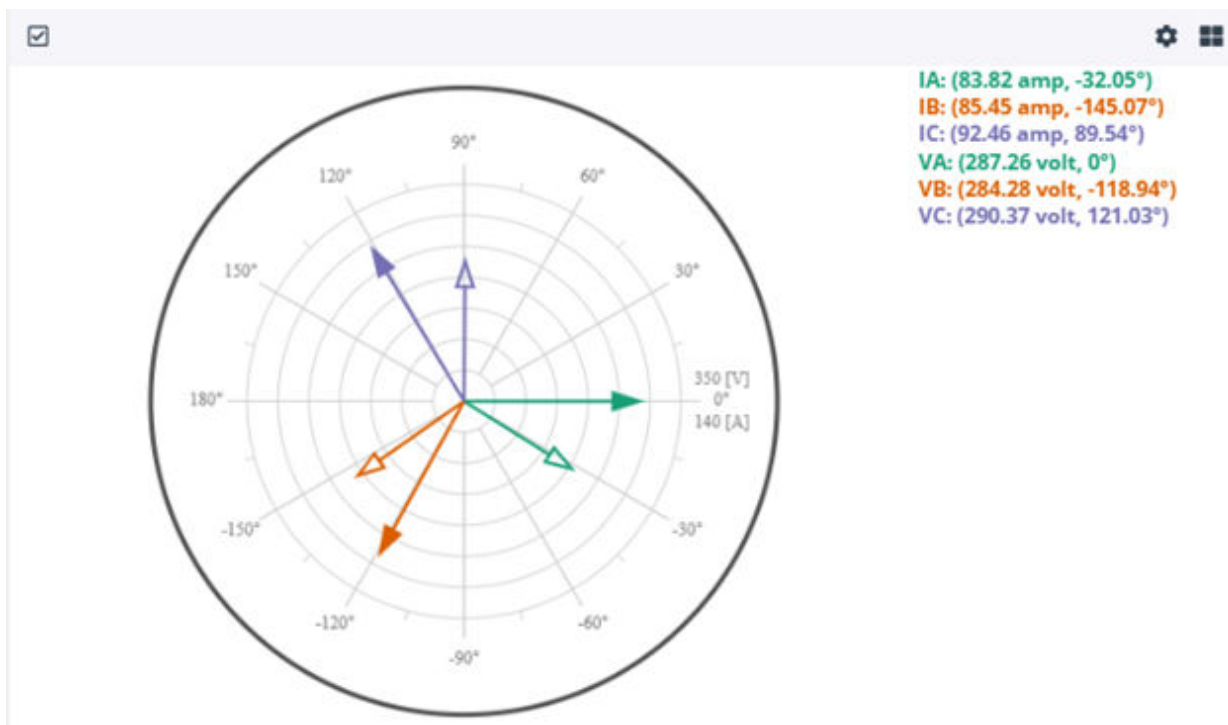
4.4. Commission Motors Using the Phasor Diagram

Use the phasor diagram to ensure that the three phases of current and voltage are in the proper relationship. With induction motors, current will lag voltage. Oftentimes during installation, phases are swapped or the polarity is flipped. Both of those conditions can be corrected in InsightCM without needing to go back into the field to make the change.

Below is an example of an installation where the current sensors were flipped in the field. Notice the B and C phasors are 180 degrees out of phase with their voltage phases. This can be corrected by checking the reverse polarity box in the asset configuration page and pushing the new configuration.



Below is the phasor diagram after the current polarity reversal. Notice each current phase lags its associated voltage phase:



5. Glossary

AWG	American Wire Gauge
CBM	Condition based maintenance
cRIO	NI Compact Reconfigurable I/O Controller.
current sensor	An instrument that senses the current flowing through a conductor and outputs a signal relative to the current being sensed to be input into a I/O device.
DC	Direct Current
ESA	Electrical Signature Analysis (ESA) is a permanently installed, non-intrusive, online monitoring system that uses three-phase voltage and current signals to detect potential faults and anomalies.
InsightCM™ (ICM)	InsightCM™ is application software for condition monitoring with full access to waveforms, multiple sensor technology inputs, enterprise software connectivity, and analytics packages.
I/O	input/output
LOTO	Lockout/Tagout
PdM	Predictive maintenance
potential transformer (PT)	A type of instrument transformer used in power systems to reduce high voltages to safer, lower levels for measurement and protection purposes.
RMS	Root Mean Square. A method of measuring the voltage or current of an AC waveform calculated by $X_{rms} = \sqrt{\frac{1}{n} * (\text{SUM}(X_n))}$, where X is the array of samples acquired and n is the number of samples acquired.
waveform	A variable that changes with time, usually representing a voltage or current. Waveforms are graphed with time on the horizontal axis.