MODULE 12

Engineering Support During Execution

Conveyor Solutions Engineering | Professional Training Program

Author and Subject Matter Expert: Michael Collins | Sr. Solutions Engineer

SECTION 1: INTRODUCTION

Eleven modules ago you learned to ask a customer the right questions. You learned to analyze what they handle, understand the building they operate in, and listen for the operational pain underneath the stated requirements.

You learned to think like the package and draw the flow before placing a single piece of equipment. You learned to calculate, select, size, guard, scope, and present.

Module 12 is where all of that goes to work.

The execution phase of a conveyor project is where the design meets the real world. Steel gets bolted to the floor. Wire gets pulled. Controllers get mounted. The drawing you spent weeks producing becomes the instruction set every trade on the job site is working from.

If that drawing is complete, accurate, and clearly communicated to everyone who needs it, the project runs. If it is not, the phone starts ringing.

A solutions engineer is not on the floor running commissioning. That is the installer's job, the controls team's job, and the project manager's job.

The solutions engineer's role during execution is different. You are the architect of the solution and the primary resource for the team executing it. You spent more time thinking about this system than anyone else. You know why decisions were made, what the constraints were, and where the design is tight or flexible.

That knowledge is what the execution team needs from you, and your job is to make sure they have it before the first bolt is tightened.

This module covers what that looks like in practice. It is the last module in the program. After it comes the Capstone Project, your first chance to do all of it at once.

SECTION 2: LEARNING OBJECTIVES

After completing this module, you will be able to:

1	Prepare installation drawings that give every trade and subcontractor exactly the information they need to execute their scope correctly.

2	Conduct pre-execution vendor conversations that surface information gaps before they become field problems.
3	Serve as the engineering resource during execution: answering questions, pulling specs, confirming intent, and preventing engineering decisions from being made without an engineer.
4	Review field redlines, evaluate requested changes for downstream impact, and produce accurate as-built documentation.
5	Execute a clean project handoff that puts the entire execution team and all subcontractors on the same page before mobilization.
6	Understand why the drawing is the golden plan and what happens to a project when it is not treated as one.

SECTION 3: PREREQUISITES

This is the final module. All prior modules are prerequisites. The specific skills that feed most directly into this one are:

Required Prior Knowledge
Module 5: System Design and Flow Layout. The layout is the primary installation document.
Module 9: Controls Integration and PLC Interface. The machine-level parameters and data handoff.
Module 10: Safety, Guarding and Code Compliance. Pull cord E-stop paths, underside cover specs, and safety device callouts belong on the drawing.
Module 11: Scoping, Quoting and Presenting Solutions. The project folder discipline from Module 11 carries directly into execution support.

SECTION 4: THE THREE W'S

WHY	The solutions engineer who hands off a complete, well-communicated drawing package and stays available as a resource during execution is the engineer whose projects run on schedule and within budget. The solutions engineer who treats the drawing as a starting point and assumes the installers will figure out the rest is the engineer whose projects generate change orders, callbacks, and customer frustration. The execution phase is the last mile. Everything you did in Modules 1 through 11 was preparation for this. The quality of your support during execution determines whether that preparation paid off.
WHEN	Engineering support during execution begins before the first subcontractor mobilizes. The pre-execution vendor conversations, the drawing review for completeness, and the handoff meeting all happen before anyone sets foot on the job site. Once execution begins, the solutions engineer is available as a resource. That availability is not passive. It is active. You check in. You ask if there are questions. You do not wait for the phone to ring when something has already gone wrong.

WHERE	The solutions engineer's support role during execution operates from the office more than from the field. Your tools are the drawing set, the project folder, the manufacturer's documentation, and the phone. When a field question comes in, you answer it from those sources. When a change is requested, you evaluate its impact from the drawing. When a part is missing or wrong, you pull the spec and coordinate with the manufacturer. You are the technical anchor for a project that is now physically in motion.

SECTION 5: CORE CONTENT

The Drawing Is the Golden Plan

Every person on the job site is working from your drawing. The mechanical installer is following it to position equipment. The electrical contractor is following it to route conduit and pull wire. The controls team is following it to mount panels, place sensors, and program setpoints. The floor layout follows it. The equipment placement follows it. The people that work on the system follow it.

When the drawing is right, everything downstream of it can be right. When the drawing is wrong, incomplete, or ambiguous, everyone working from it is making decisions that should have been made at the engineering stage. They are filling gaps with assumptions. And assumptions in the field cost money and time in ways that assumptions on paper do not.

The drawing is not a starting point. It is the plan. Treat it that way from the moment you begin producing it.

FIELD INSIGHT | MICHAEL COLLINS

THE DRAWING IS THE GOLDEN PLAN. Every trade on the job site is working from what you put on that drawing. If the speed callouts are missing, the controls team does not know what the plan was. If the pull cord E-stop path is not shown, the electrical contractor does not know it is required. If the equipment dimensions are wrong, the mechanical installer builds to the wrong footprint. Get the drawing right before the project mobilizes. Everything else depends on it.

Preparing Installation Drawings That Work in the Field

An installation drawing that works in the field is one that answers every question a trade might have without requiring a phone call. That standard sounds high. It is achievable. It requires one discipline above all others: before the drawing is released, talk to every vendor and ask them what they need to see on it.

This is not a small task and it is consistently skipped. Engineers assume the mechanical installer knows what information they need. They assume the controls team will ask if something is missing. The problem is that people do not always know what they do not know. A controls programmer who has never seen a system like yours does not know to ask for the conveyor speed callouts they will need to set up the VFDs. A mechanical installer working in a tight bay does not know to ask for the equipment clearance dimensions unless they are shown.

Ask the questions before the drawing is finalized. Call the controls team. Call the mechanical contractor. Call the electrical contractor. Ask each one specifically: what do you need to see on the drawing to execute your scope without ambiguity? The answers will tell you what is missing. Add it before the drawing is released.

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Not talking to each vendor and asking what information they need on the drawing is one of the most common execution preparation mistakes. What callouts do they need to support their role? The controls team needs to know the conveyor speeds we engineered. All the work we did in Module 6 to calculate the right belt speeds means nothing if those speeds are not called out on the drawing for the controls team to program. Ask every trade what they need. Then put it on the drawing.

What Belongs on an Installation Drawing

Drawing Element	Who Needs It	What Happens Without It
Equipment layout with dimensions and clearances	Mechanical installer	Equipment placed in wrong location or wrong orientation
Conveyor belt speeds gap expectations and more	Controls team	System programmed may not make rate or damage product
Sensor locations with mounting angles	Mechanical and controls	Sensors placed incorrectly - detection failures or incorrect leading/trailing edge tracking
Pull cord E-stop path and	Electrical contractor	Pull cords not installed properly causing safety gaps in the field
Underside cover specifications and locations	Mechanical installer	Covers omitted - safety and compliance exposure
Aux I/O module locations	Controls team	Wrong number of modules ordered or mounted in wrong zones
PLC delay values at transfer points	Controls team	Transfer timing wrong - product stops in wrong position
Safety gate interlock locations and switch type	Electrical and controls	Standard switches installed instead of safety-rated - audit failure
Power requirements and disconnect locations	Electrical contractor	Wrong circuit sizing or inaccessible disconnects. Overdrawn power supplies
Accumulation zone release mode callouts	Controls team	Zones programmed to wrong release behavior

The Solutions Engineer as Architect and Resource

Once execution begins, the solutions engineer's role shifts from producer to resource. The drawing has been released. The trades are mobilized. The project manager is managing the schedule and budget. Your job is to be available, knowledgeable, and fast when questions come in.

You are the architect of this solution. You spent more hours thinking about this system than anyone else on the project. You know why the sorter is that model and not a different one. You know why the accumulation zones are sized the way they are. You know what the speed calculations showed and what margin is built in. When a field question comes in, that knowledge is what the installer or the controls team needs access to.

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When something goes wrong during execution, the engineer may need to get the manufacturer on the phone, pull customer specs to verify something, or work through the project management team to get a resolution. Parts not on site when needed, wrong cables ordered, a controller that does not match the spec: all of these happen. The solutions engineer is the master of the design. They are a resource. They are the architect of the solution, and the execution team depends on that knowledge when problems surface.

Common Execution Support Scenarios

The following situations arise on almost every project. Knowing how to handle each one before it happens is part of execution preparation.

Parts not on site when needed

An Aux I/O cable was not ordered because it was not called out in the order. The EZLogic controllers are on site but the interface to them are not. The system cannot be commissioned without them. The solutions engineer pulls the Hytrol EZLogic documentation, confirms the correct cable part number, contacts the manufacturer, and coordinates with the project manager on the expedite. The controls team does not have to lose a day hunting down a part number they were not given.

A field question about intent

The mechanical installer is at the merge point and the drawing shows the belted conveyor upstream of the merge but does not show a specific dimension for the transition. They call. You pull the drawing and the flow diagram. You know from Module 8 that the upstream belted section was specified to address the air accumulation reliability risk at the merge. You explain the intent and give the dimension from your design notes. The installer continues without delay.

A controls team question about speed setpoints

The controls programmer is setting up the VFDs, or E24 zone Speeds and the drawing does not show speed callouts. They call. If the speeds are in the project folder from the Module 6 calculations, you have the answer in two minutes. If the speeds were never documented outside your memory, this becomes a longer conversation and a potential rework risk if the wrong speeds are programmed and the system does not make rate on the first test.

Redlines, Changes, and As-Built Drawings

No project gets built exactly as drawn. Field conditions, unforeseen structural elements, equipment that arrives slightly different from the spec, customer requests made during installation: all of these produce changes. The mechanism for capturing those changes is the redline.

A redline is a markup made on a printed drawing by someone in the field showing what was changed from the original design. Redlines come back to the solutions engineer at the end of the project. Your job is to review every redline, evaluate whether the change was within the design intent, update the drawing to reflect what was actually built, and produce the as-built drawing set.

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The solutions engineer owns installation drawings, as-built drawings, and the review of redlines from the field. When a change is made in the field, it is the engineer's job to know what other things that change may affect and weigh that against the requested change. A change to one section of the system does not happen in isolation. The drawing connects everything. You have to think through the downstream effects before approving a change and then capture it accurately in the as-built.

Evaluating a Requested Change

When a change is requested in the field, the solutions engineer does not simply approve it and update the drawing. The engineer asks what else that change affects.

Evaluate every change for downstream impact. Document the evaluation. If the change is approved, update all affected elements on the drawing. If the change has downstream consequences that require additional design work, that design work happens before the field proceeds.

Change Request Type	Questions to Ask Before Approving
Equipment position moved	Does this change require upstream or downstream changes too. This may affect everything
Conveyor model substituted	Does the substitute match the speed range? Weight capacity? Zone length? Roller centers for the product?
Sensor relocated	Does the new position still provide correct detection for the PLC delay calculation from Module 8?
Speed setpoint adjusted during startup	Was the original speed calculated to a throughput target? What happens to rate if the speed changes?
Safety device relocated	Does the new location still provide required coverage? Is the cord reach still accessible to operators?

The Project Handoff: Putting Everyone on the Same Page

A good project handoff is one where the execution team and every subcontractor know where all the skeletons are hiding before the project starts. The easy things are not the problem. Everyone knows how to install a straight run of accumulation conveyor. What they do not know is the specific, non-obvious decisions that were made during design on this project, for this customer, in this building.

We do not know what others do not know. That is the core problem with project handoffs. The engineer assumes the controls team knows that the merge upstream of the sorter requires a belted induction section because of the air accumulation risk. The controls team assumes the mechanical team knows the sensor at the transfer needs to be offset from center by the amount in the PLC delay calculation. Nobody is wrong. Nobody communicated what they knew.

FIELD INSIGHT | MICHAEL COLLINS

A good handoff is one where the execution team and all vendors know where all the skeletons are hiding. The easy stuff is not the problem. We do not know what others do not know. We need to make sure everyone is on the same page. That means a meeting, a drawing walkthrough, and specific callouts for every non-obvious decision in the design. If you engineered something that required judgment to get right, that judgment needs to be communicated before the project starts.

What a Pre-Execution Handoff Meeting Covers

Walk the drawing with every trade present.	Not just the project manager. Every subcontractor who will be on site.
Call out every non-obvious decision.	If you made a design choice that required engineering judgment, explain it. The installer does not need to understand the full calculation. They need to understand the intent.
Identify every interface between trades.	Where does the mechanical scope end and the electrical scope begin? Where does the electrical scope end and the controls scope begin? Every interface is a potential gap.
Confirm what every vendor received in their scope package.	If anything was missing from an RFQ, surface it now before it surfaces as a change order.
Distribute the CSE Project Notes Template for the project.	Every trade should know where to find the design reference if a question comes up in the field.
Agree on the redline process.	How do field changes get documented? Who approves them? How do they get back to the engineer for as-built updates?

SECTION 6: TIPS AND TRICKS

TIPS AND TRICKS | MICHAEL COLLINS

Before any drawing is released for construction, call every vendor individually and ask them one question: what do you need to see on this drawing that is not there yet? The answers will improve every drawing you ever produce.

Speed callouts are not optional. Every belt speed that was calculated and selected during design must appear on the installation drawing. The controls team cannot program what was not communicated.

When a field change comes in, your first question is never yes or no. Your first question is: what else does this affect? Think through the full system before you approve anything.

Redlines are not a sign that the design was wrong. They are a normal part of construction. The discipline is in capturing them accurately and updating the as-built completely. A redline that never makes it into the as-built is a gap in the project record.

Be reachable during execution. The phone call that gets answered in two minutes saves an hour of installer downtime. The phone call that goes to voicemail turns into a field decision made without engineering input.

The project folder from Module 11 is what makes you a good resource during execution. If your calculations, your specs, and your design notes are organized and accessible, you can answer field questions fast. If they are scattered or missing, you are reconstructing the design from memory under pressure.

SECTION 7: NOTES AND INSIGHTS

NOTES AND INSIGHTS

The solutions engineer is not the project manager during execution. The project manager owns schedule, budget, and subcontractor coordination. The solutions engineer owns the design. Those are different roles and both matter. Stay in your lane and be excellent at it.

As-built drawings are legal documents. They represent what was actually built, not what was originally designed. A customer who wants to expand their system five years from now will work from the as-builts. If those drawings do not reflect reality, the expansion design starts from a false premise.

The best time to catch a drawing error is during the pre-execution vendor conversation. The worst time is during installation. Build the habit of reviewing drawings with the execution team before the project mobilizes.

Every non-obvious design decision that lives only in the engineer's memory is a risk. If you made a judgment call during design, document it in the CSE Project Notes Template. That documentation is what allows another engineer to support the project if you are unavailable.

A change that seems small in the field often has a larger footprint in the design. A two-foot position shift can affect curve geometry, accumulation zone length, sensor placement, and pull cord spacing simultaneously. Evaluate changes at the system level, not the local level.

SECTION 8: EXPERT CALLOUT

[Expert callout placeholder — peer review insight to be added here. Reviewer name, title, and company will appear in this box when peer review is completed.]

SECTION 9: PITFALLS

These are real mistakes. Every one of them has a field history.

! **Releasing a drawing without talking to the trades**

The drawing that goes out without a pre-release conversation with each subcontractor is the drawing that generates the most RFIs. Call every trade before release. Ask specifically what they need to see. The answer will change what you put on the drawing.

! **Omitting speed callouts and setpoints**

The belt speeds calculated in Module 6 to hit the throughput target mean nothing if they do not appear on the drawing. Controls teams program from what they receive. If setpoints are missing, they estimate. Estimates are not engineering.

! **Approving field changes without evaluating downstream impact**

	A yes to a field change that was not fully evaluated is a yes to every downstream consequence of that change. Equipment position changes affect accumulation zones. Accumulation zone changes affect zone timing. Zone timing affects throughput. Evaluate before approving.
!	**Not collecting and processing redlines** Redlines that stay on the installer's clipboard never become as-builts. As-builts that do not exist cannot be referenced when something fails. Collect redlines at every site visit. Process them immediately. The project is not complete until the drawing reflects what was actually built.
!	**Being unavailable during execution** An engineer who is hard to reach during execution forces the field to make engineering decisions without an engineer. Those decisions are made with incomplete information. Be reachable. If you cannot answer immediately, set a response time expectation and meet it.
!	**Assuming the handoff meeting replaces the drawing** A great handoff meeting is not a substitute for a complete drawing. Verbal instructions given in a meeting are forgotten. Details discussed verbally but not documented do not exist when a dispute arises six months later. The drawing must stand on its own.

SECTION 10: FOREST THROUGH THE TREES

Module 1 taught you to discover what the customer actually needs. Module 2 taught you to understand what they actually handle. Modules 3 and 4 gave you the technology vocabulary to match equipment to requirements. Module 5 taught you to design the flow before you drew a single line. Module 6 gave you the calculations to make that flow real. Modules 7 and 8 taught you the transitions and the sortation that make a system more than a straight run. Module 9 connected the machines to the systems that direct them. Module 10 built safety into the design from the beginning. Module 11 turned the engineering into a proposal a customer could sign.

Module 12 closes the loop. The drawing that came out of all of that work now becomes the instruction set for a project that is physically happening. The quality of your support during that phase is the final test of whether the engineering work was complete.

The forest is this: a solutions engineer who can take a customer's problem, engineer a solution, produce a complete drawing, communicate it clearly to every trade, stay available as a resource during execution, manage changes with full awareness of their downstream effects, and hand the customer an as-built drawing that accurately represents what was built - is an engineer who can be trusted with the next project. And the one after that.

That is what this program was built to produce.

SECTION 11: KEY TAKEAWAYS

KEY TAKEAWAYS | MODULE 12

The drawing is the golden plan. Every trade on the job site is working from it. It must be complete, accurate, and reviewed with every subcontractor before the project mobilizes.

Talk to every vendor before releasing a drawing. Ask each one specifically what they need to see to execute their scope without ambiguity. Then add what is missing.

Speed callouts, setpoints, sensor locations, accumulation zone configurations, and safety device specifications all belong on the installation drawing. If they are not there, they will not be installed correctly.

The solutions engineer is the architect of the solution and the primary technical resource during execution. Be available. Be fast. Know your design.

Every field change must be evaluated for downstream impact before it is approved. A change to one part of the system can affect many others.

Redlines are a normal part of construction. Collect them. Evaluate them. Update the drawings. Produce complete as-builts that reflect what was actually built.

A good handoff puts everyone on the same page about the non-obvious decisions in the design. The easy stuff takes care of itself. The skeletons need to be surfaced before the project starts.

The CSE Project Notes Template and the project folder are what make you a useful resource during execution. Organized documentation is the difference between a two-minute answer and an hour of reconstruction.

SECTION 12: MODULE ASSESSMENT

Answer the following questions to test your understanding of Module 12.

Q1

You are preparing to release an installation drawing package for a fulfillment center conveyor project. You have talked to the mechanical installer and the controls team. The mechanical installer says everything looks good. The controls team has not responded to your two emails. Your project manager is pushing you to release because the mobilization date is in four days. What do you do?

Q2

Midway through installation, the mechanical installer calls and says a structural column is in the way of the conveyor run as drawn. Moving the conveyor 18 inches to the left would clear the column. The installer wants your approval to make the move. What is your process before you say yes or no?

Q3

At the end of the project, the installer hands you a stack of redlined drawings. Three of them show equipment that was moved from the designed position. One shows a speed setpoint that was changed in the field. Two show sensor locations that were adjusted. What do you do with these, and what is the consequence if you do not process them?

Q4

A new engineer on your team says they plan to handle field questions from memory during execution because the project folder takes too much time to maintain and the drawings are all in their head. How do you respond, and what specific failure mode are you trying to prevent?

Forest Reflection

Look back at the full arc of this program from Module 1 through Module 12. Describe how a single gap at any stage, a missed input parameter in discovery, an under-scoped BOM, a drawing released without vendor conversations, could compound through every subsequent stage. What does this tell you about the relationship between the disciplines in this program?

A NOTE FROM MICHAEL COLLINS

To the engineer who made it this far.

I love this industry.

I love that no two projects are the same. I love that the problems are real, the stakes are real, and the solutions have to work in the physical world, not just on a screen. I love sitting across from a customer who has a problem they cannot solve and knowing that I have the tools to help them solve it.

What I love most is that sometimes the right answer is a complex, sophisticated system with multiple technologies, a full control architecture, and months of engineering work. And sometimes, after all that thinking, after running every calculator, stress testing every assumption, and walking the flow a hundred times in my head, the right answer is something elegant and simple. A system that solves a complex problem with the minimum number of moving parts, the minimum cost, and the minimum risk.

When I find that answer, when the elegant, simple solution is sitting right there and I can see it clearly, that is the best feeling in this work.

I have imagined myself sitting in the box riding through a system I designed, feeling every transfer, every curve, and every accumulation zone. When the ride is smooth, when there are no surprises, when it just works, that is what this is all for.

You just completed twelve modules. You have the foundation. You have the frameworks, the calculators, the field knowledge/Key Takeaways, and the professional habits that took me years to develop. Now go to the Capstone Project and use all of it. Then go find a real project and do it again.

The industry needs engineers who think this way. I am glad you are one of them.

Michael Collins

Sr. Solutions Engineer

Author, Conveyor Solutions Engineering Professional Training Program

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WHAT COMES NEXT

The Capstone Project is a separate document titled CSE Capstone Project: Riverside Fulfillment Center. It is a complete, standalone project brief that asks you to apply every skill from every module to a realistic outbound conveyor system design. It has a customer, a building, a product mix, a throughput requirement, and a set of constraints that will lead you to specific conclusions about the technology, the layout, and the solution.

The Capstone Project is not a test with right and wrong answers. It is an engineering exercise with better and worse answers. Your job is to make defensible decisions based on what the data tells you, document your reasoning, produce real deliverables, and present a solution you would be willing to put your name on.

That is the job. Have fun, ask questions. Enjoy the work.